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**LANDFILL REMEDIATION
FEASIBILITY STUDY**

DEVENS, MASSACHUSETTS

VOLUME II OF II

APPENDICES A THROUGH F

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**U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND,
MARYLAND**

JANUARY 1997

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BCT PLAN OF ACTION

ABB Environmental Services, Inc.

**BCT PLAN OF ACTION
MANAGEMENT OF DEBRIS DISPOSAL AREAS
FORT DEVENS, MASSACHUSETTS**

**Prepared by U.S. Army
for
BCT Meeting of March 31, 1995**

MARCH 1995

BCT PLAN OF ACTION MANAGEMENT OF DEBRIS DISPOSAL AREAS

INTRODUCTION

During the collection of information for preparation of the Master Environmental Plan (MEP) and subsequent studies, the Army has identified a number of demolition debris disposal areas throughout Fort Devens. These disposal areas are in addition to the Shepley's Hill Landfill which has served as the primary solid waste disposal location at the installation. This 80-acre facility (AOC 5) is closing under a state-approved Resource Conservation and Recovery Act (RCRA) Subtitle D Closure Plan and is being further studied under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA - "Superfund").

The disposal areas have been the subject of investigations under CERCLA for the past three years. Table 1 presents information on the seven most significant disposal areas which are the primary focus of this discussion. The debris disposal areas have been found to pose varying risks to public health and the environment. The Army has determined from discussions with both federal and state regulatory agencies that all disposal areas must be managed, with the minimum requirements being those outlined in the Massachusetts solid waste management regulations. The Army and its contractors have been developing management options based on the degree of threat, cost, and technical practicality.

At one point in the assessment process, the Army considered nominating the lowest risk disposal areas for No Further Action (NFA) under CERCLA and managing them under the State solid waste regulations. However, it was finally decided to address all the disposal areas under CERCLA due to the benefits of: (1) a consistent administrative approach for all sites; (2) similarity of waste material; and (3) the administrative difficulty in mixing CERCLA and non-CERCLA waste.

The management of the debris disposal areas is being further influenced by property reuse considerations. The Massachusetts Government Land Bank (MGLB) and its consultants have indicated that water supply and wastewater resources, as well as property values, will be affected by the management options chosen for the disposal areas.

Additionally, the Army has recognized the potential positive impacts of managing debris disposal areas in a holistic manner, in particular the cost savings from lower operating and maintenance requirements at a consolidated disposal area.

Fort Devens, Massachusetts

PURPOSE

The purpose of this Plan of Action is to identify and evaluate options, and document BCT decisions relative to disposal area management that will:

1. provide the optimum combination of protectiveness and cost;
2. accelerate restoration;
3. attain the highest public acceptance;
4. reduce the Army's long-term CERCLA liability; and
5. to the extent practical, alleviate land use restrictions.

BACKGROUND

The following information summarizes the current situation at Shepley's Hill Landfill and the significant debris disposal areas at Fort Devens (see also Table 1).

AOC 5 - Shepley's Hill Landfill. The RI/FS work effort is complete and the Army has prepared a Proposed Plan for comment. The plan calls for some important cap improvements, groundwater monitoring, and a contingency for groundwater extraction and treatment if the present closure proves ineffective in mitigating the off-site migration of contaminants (primarily arsenic) in groundwater.

The plan relies on regulatory acceptance of closure of the landfill under the Massachusetts solid waste regulations. At this time, the state agency has identified some deficiencies in the submittal of closure documentation by the Army. EPA has stated that it is unwilling to execute the ROD until all State requirements are satisfied.

SA 6 - South Post Farm Dump. The Army has characterized this small disposal area by test pitting. However, analytical samples have not been collected. Since this area contains only 500 cubic yards of waste, the Army has decided that its removal is the most effective solution.

Fort Devens, Massachusetts

AOC 9 - North Post Landfill. SI work has been completed and data indicate that there is little ecological risk posed by the approximately 56,000 cubic yards of waste. However, contaminant levels in groundwater monitoring wells above MCLs are a concern to EPA.

The MGLB is evaluating the potential physical and environmental impacts from continued use and improvements to the wastewater treatment facility. A key concern is that increased water infiltration may force groundwater into the disposal area material, potentially exacerbating contaminant release.

The AOC 9 area, due to its location near the wastewater treatment facility and remote installation location, has limited future use potential and is a candidate site for consolidating debris from other locations.

AOC 11 - Lovell St. Landfill. RI work is ongoing at this 35,000 cubic yard disposal area located in a meander of the Nashua River. In-place closure of the disposal area may prove technically difficult and environmentally unsuitable.

SA 12 - Range Control Landfill. SI work has been completed and data indicate that there is little risk posed by the approximately 9,000 cubic yards of waste which has been discarded over a steep embankment into the Nashua River wetland. Since in-place closure of the disposal area at the steep grade appears impractical, the Army has decided that its removal is the most effective solution.

SA 13 - Lake George St. Landfill. This 10,000 cubic yard debris disposal area poses no significant risk as shown by SI efforts. In-place closure of such a small area appears impractical and, therefore, removal of the waste is the recommended Army solution.

AOC 40 - Cold Spring Brook Landfill. The Army's RI/FS efforts were recently completed and a Proposed Plan was being drafted when the regulatory agencies and the MGLB questioned the adequacy of the waste characterization. The primary issue for those parties is the proximity of the landfill to the Patton Road Well. The BCT tentatively agreed that in-place closure of the 100,000 cubic yards of waste material with an enhanced RCRA Subtitle D (composite) cap with pre-design investigations directed at defining waste extent and characteristics will satisfy MADEP and USEPA concerns and allow the ROD process to proceed.

Fort Devens, Massachusetts

AOC 41 - South Post Farm Dump. SI efforts were completed in the debris area and RI efforts are ongoing for groundwater contamination. This 1,500 cubic yard debris disposal area poses no significant risk. In-place closure of such a small area appears impractical and, therefore, removal of the waste is the recommended Army solution.

DISPOSAL OPTION DEVELOPMENT

The Army's available data and information indicate that in-place containment of the larger dumps (9,40) would be more cost-effective than excavation and consolidation at a central facility or, alternatively, excavation and off-site disposal.

Specifically, the FS for AOC 40 showed that there would be an approximate \$3 million difference between closure in-place and disposal at a specially constructed consolidation facility. (An economy of scale was built in, at MADEP's request, considering an amortized rate per yard based on construction and use of a consolidation facility which would accommodate more than double the capacity needed for AOC 40.) Based on this information alone, it has been difficult for the Army to justify the \$3 million expense to satisfy the MGLB's water supply concerns.

At the request of the Fort Devens Deputy Installation Commander, a matrix of six debris disposal options and evaluation criteria was developed in cooperation with the regulatory agencies and the MGLB (see Table 2). The options and evaluation criteria were established during a "brainstorming" session at the BCT meeting of January 25, 1995.

Some important assumptions in the development of options include:

1. Based on previous siting studies for Fort Devens, there are only two adequate waste consolidation locations: the North Post Landfill and the area near Shepley's Hill Landfill.
2. The consolidation facility must have a bottom liner, leachate collection, and a single top liner (Subtitle D) to meet MADEP requirements.
3. Consolidation on top of the closed Shepley's Hill Landfill is not technically and economically justifiable due to waste settling issues. Therefore, the Army has established that any consolidation facility would be built as a separate unit next to the main landfill.
4. Based on MADEP solid waste requirements (and settlement issues), consolidation at the North Post Landfill would require excavation of AOC 9, construction of a bottom liner and leachate collection system, and replacement of the AOC 9 material in the

Fort Devens, Massachusetts

new facility. No consideration has been given to construction of the consolidation facility directly on top of portions of the undisturbed North Post Landfill.

5. The smaller debris disposal areas (6,12,13,41) will be addressed as a single "bundle" of wastes. Engineering and design associated with these four areas will be coordinated and a single solution for all four will be established.
6. As per discussions with the regulatory agencies, an enhanced Subtitle D cap will be required for in-place containment of AOC 40. Subtitle D caps are assumed here for in-place containment of AOCs 9 and 11. However, AOC 9 could require closure with a Subtitle C cap, depending upon the outcome of further investigations.
7. Excavation and relocation of debris disposal areas will eliminate the need for environmental monitoring at the excavation site.
8. The consolidation facility will not accept hazardous waste and, therefore, will be designed as a Subtitle D facility. Hazardous waste, encountered during excavation, will be managed at an off-site RCRA-approved facility.
9. The Army will consider (but may reject) landfill reclamation based on technical practicality and cost-effectiveness.

Based on meetings and discussions, the regulatory agencies and the MGLB have expressed preference for Option No.2, excavation of all the debris disposal areas and consolidation at the Shepley's Hill Landfill area facility.

OPTIONS ANALYSIS

The matrix of Table 2 evaluates each of the six options against ten evaluation criteria which were established during the BCT brainstorming session.

Long-term Effectiveness. This criterion represents the overall effectiveness of the option to meet its goal of protection of public health and the environment. Due to the generally low existing risk levels and the sophisticated design required by the applicable regulations, all options will be highly effective. However, removal of debris provides a level of reliability which is greater than in-place closure, assuming the possibility of an unexpected release from a landfilled container or flooding in the Nashua. The long-term effectiveness of any option which leaves AOC 9 in-place may be affected by the expansion of the wastewater treatment facility.

Fort Devens, Massachusetts

Short-term Impacts. This criterion addresses the effects of construction activities on the public and the environment. In short, higher levels of excavation and hauling activity associated with debris disposal consolidation will have greater impacts, such as dust and noise generation.

Infrastructure Impacts. This criterion primarily addresses the effects of implementation on the building of new roads and facilities. Two locations are affected most: AOC 40 due to planned Patton Road improvements; and AOC 9 due to planned continued use and improvements to the wastewater infiltration system. Although these issues can be handled during in-place closure engineering, the overall impacts are lessened by disposal area removal.

Water Supply Impacts. This criterion is directed primarily at potential impacts on Patton Well from AOC 40. Although investigations have shown only low-level metals contamination of groundwater in the vicinity of the debris, debris removal will reduce any uncertainty and eliminate the need for any contingency planning.

Implementability. This criterion addresses the ease of construction, including meeting regulatory and administrative process requirements. In general, in-place containment is easier to implement than excavation, hauling, and construction of a new consolidation landfill. However, there are uncertainties associated with controlling groundwater infiltration of the waste at AOC 9 and controlling erosion of AOC 11 waste during Nashua River flood conditions. The U.S. Fish & Wildlife Service has expressed concern about in-place closure of AOC 11 in the Nashua River area.

Landfill Management. This criterion considers the administrative difficulties associated with the long-term management of closed landfill facilities. In short, more landfills require more complicated logistical efforts.

Cost. Costs include capital and O&M. Table 3 shows the level of detail that has been used in the analysis.

Land Reuse Potential. In general, in-place closure restricts land reuse.

Fort Devens, Massachusetts

Public Acceptance. This criterion is a general assessment of the public's preference. Experience has shown that excavation and consolidation of debris is preferred by the public. However, experience has also shown that the public is adverse to the unwise expenditure of public funds.

CONCLUSIONS

Of primary importance to the BCT is that, although the site-specific FS for AOC 40 showed an approximate \$3 million difference between in-place closure and moving waste to a consolidation landfill, Tables 2 and 3 show that when considering the management of all debris disposal areas on Fort Devens, the overall cost difference between Option No.1 (low cost option) and Option No.2 remains at about \$3 million. This is due to the following basic costing issues:

1. Due to economy of scale, it is \$800,000 less expensive to consolidate the debris area bundle with other waste than to dispose of the 20,000 yards off-site.
2. It is equally expensive to remove AOC 11 as to cap in-place due the logistics of working in the Nashua River floodplain.
3. It is approximately \$800,000 more expensive to excavate and consolidate AOC 9 than to close it in place.

In addition to being more costly, disposal area excavation/consolidation poses other disadvantages, including higher hazard potential for site workers, the potential for noise and dust generation, impacts on existing roadways, and a longer implementation schedule associated with the design and construction of the consolidation facility.

The advantages of consolidation include the elimination of any environmental monitoring, insurance against future subsurface container releases at each disposal area and flooding of the Nashua River near AOC 11. Another key advantage to the BCT is quick community acceptance which will reduce delays in the ROD and remedial action process. The administrative issues related to long-term monitoring at many closed landfills will also be mitigated.

Other advantages of consolidation over in-place closure relate to infrastructure, water supply, and land reuse impacts. Although these factors do not directly affect the Army which is closing Fort Devens, there is still an indirect affect due to community acceptance of the remedy.

Fort Devens, Massachusetts

RECOMMENDATIONS

Based on the analysis presented in Table 2, considering the stated advantages to consolidation of debris disposal areas, it may be practical for the BCT to consider the implementation of Option 2. However, this will result in an approximately \$3 million incremental cost over the low cost Option No.1.

The incremental cost for excavation and consolidation can be offset by savings in a number of areas, contingent upon regulatory agency and MGLB acceptance. Many of the cost saving considerations were discussed and agreed to at the BCT meeting of March 15, 1995. These considerations, which include many of the assumptions outlined in the Disposal Option Development section of this Plan of Action are outlined below:

1. Consolidation on top of the closed Shepley's Hill Landfill is not technically and economically justifiable due to waste settling issues. Therefore, any consolidation facility would be built as a separate unit next to the main landfill.
2. Excavation and relocation of debris disposal areas will eliminate the need for environmental monitoring at the excavation site.
3. The Army will consider (but may reject) landfill reclamation based on technical practicality and cost-effectiveness.
4. The consolidation facility will not be designed for hazardous waste disposal and, therefore, will be designed with a Subtitle D cap. Hazardous waste, encountered during excavation, will be managed at an off-site RCRA-approved facility.
5. A single consolidation FS/PP/ROD will suffice to administratively manage all the debris disposal areas under CERCLA, with the AOC 40 FS incorporated by reference.
6. Because Option 2 includes the excavation and removal of landfilled materials at AOC 09, the need to conduct a formal RI at this disposal area can be eliminated.
7. The regulatory agencies agree that, with the removal of debris and associated residual contamination, no additional sampling will be necessary in these areas.
8. Certain contaminated and uncontaminated soils can be used in the consolidation facility if the waste meets MADEP solid waste disposal policy limits.
9. Interim storage of contaminated and uncontaminated soils to be discarded in the landfill will be allowed at Building 202 as long as the appropriate containment and

Fort Devens, Massachusetts

control efforts exist. MADEP agreed that soils contaminated with PCBs at concentrations less than 50 ppm can be stockpiled as long as it is properly controlled.

10. The MGLB will consider providing financial assistance to help offset the cost differential between Option 1 and the selected Option 2.

Fort Devens, Massachusetts

USEPA and MADEP signatures constitute concurrence with this BCT Plan of Action.

James C. Chambers

JAMES C. CHAMBERS
BRAC Environmental Coordinator

31 MAR 95

Date

U.S. ENVIRONMENTAL PROTECTION AGENCY

James P. Byrne

JAMES P. BYRNE
Fort Devens Remedial Project Manager

3/31/95

Date

☒ Concur
☐ Non-concur (Please provide reasons for non-concurrence in writing)

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

D. Lynne Welsh

D. LYNNE WELSH
Section Chief, Federal Facilities - CERO

3/31/95

Date

☒ Concur
☐ Non-concur (Please provide reasons for non-concurrence in writing)

In addition, MGLB signature constitutes concurrence with this BCT Plan of Action.

David S. Knisely

DAVID S. KNISELY
Counsel, Massachusetts Government Land Bank

3/31/95

Date

☒ Concur
☐ Non-concur (Please provide reasons for non-concurrence in writing)

Fort Devens, Massachusetts

**TABLE 1
DEBRIS DISPOSAL AREA SUMMARY**

SA/AOC No.	Name	Estimated Volume (cy)	Current Status
6	South Post Farm Dump	500	Test pitting complete. Removal recommended.
9	North Post Landfill	56,000	SI complete. Ready to initiate RI/FS.
11	Lovell St. Landfill	35,000	RI near completion.
12	Range Control Landfill	9,000	SI complete. Removal recommended.
13	Lake George St. Landfill	10,000	SI complete. Removal recommended.
40	Cold Spring Brook Landfill	40,000	RI/FS complete. Ready to issue Proposed Plan.
41	South Post Farm Dump	1,500	SI complete. Removal recommended for debris area. RI ongoing for groundwater.

TABLE 2

SOLID WASTE LANDFILL MANAGEMENT OPTIONS
FT. DEVENS, MASSACHUSETTS

OPTION	LONG-TERM EFFECTIVENESS	SHORT-TERM IMPACTS	INFRASTRUCTURE IMPACTS	WATER SUPPLY IMPACTS	IMPLEMENTABILITY
1. • Cap in Place: 9, 11, 40 • Off-Site Disposal: Bundle (8, 12, 13, 41)	Landfill cap prevents leachate generation, thereby protecting groundwater quality. Low-tech maintenance. Effectiveness measured by post-closure groundwater monitoring. Expected cap life is 30 years minimum.	Of the options, No. 1 offers least amount of adverse short-term impacts because only 10% of landfilled waste is relocated. One-time noise and dust impacts from construction equipment can be mitigated.	Patton Road improvement must be over AOC 40 cap. Uncertainties related to sand filter beds at AOC 9 remain.	AOC 40, within Zone II of Patton supply well, would be capped in place.	No significant obstacles to implementation. Could be completed within a single construction season. Engineering measures potentially required at AOC 9 to control groundwater table elevation. Capping AOC 40 in place could potentially hinder air quality mitigation measures by conflicting with Patton Road expansion.
2. • Consolidate near SHL: 9, 11, 40, Bundle	Degree of groundwater protection similar to all other options. Reliability of remedy improved over cap in-place. Reduces uncertainty from flooding at AOC 11.	Greatest one-time noise and traffic-related impacts to on-post and off-post residents.	Eliminates design problems for Patton Road improvement. Eliminates uncertainties related to sand filter beds at AOC 9.	Eliminates groundwater and water supply concerns at AOCs 9 and 40.	Additional time required to relocate 211,000 cu yd of solid waste; may require two construction seasons. Potential wetlands restoration at AOC 9.
3. • Cap in Place: 11 • Consolidate at NPL: 9, 40, Bundle	Degree of groundwater protection similar to all other options. Fails to address potential flooding at AOC 11.	Decreased one-time noise and traffic-related impacts to on-post and off-post residents relative to Option 2.	Eliminates design problems for Patton Road improvement. Uncertainties related to sand filter beds at AOC 9 remain.	Eliminates water supply concerns at AOC 40. Waste location relative to groundwater table is an issue at AOC 9.	See Option 1.
4. • Consolidate at NPL: 9, 11, 40, Bundle	Degree of groundwater protection similar to all other options.	Slightly increased traffic-related impacts relative to Option 3 because more waste is relocated.	Eliminates design problems for Patton Road improvement. Uncertainties related to sand filter beds at AOC 9 remain.	Eliminates water supply concerns at AOC 40. Waste location relative to groundwater table is an issue at AOC 9.	See Option 1.
5. • Cap in Place: 9, 11 • Consolidate near SHL: 40, Bundle	Degree of groundwater protection similar to all other options. Fails to address potential flooding at AOC 11.	Impacts similar to Option 3.	Eliminates design problems for Patton Road improvement. Uncertainties related to sand filter beds at AOC 9 remain.	Eliminates water supply concerns at AOC 40. Waste location relative to groundwater table is an issue at AOC 9.	Potential engineering measures to control groundwater table elevation at AOC 9.
6. • Cap in Place: 40 • Consolidate near SHL: 9, 11, Bundle	Degree of groundwater protection similar to all other options. Eliminates uncertainties related to sand filter beds at AOCs 9 and 11. Reduces uncertainty from flooding at AOC 11.	Slightly less impact than Option 5.	Infrastructure impacts on Patton Road improvement. Eliminates uncertainties related to sand filter beds at AOC 9.	AOC 40, within Zone II of Patton supply well, would be capped in place.	Potential engineering measures to control groundwater table elevation at AOC 9. Capping AOC 40 in place could potentially hinder air quality mitigation measures by conflicting with Patton Road expansion.

TABLE 2 (CONT.)
SOLID WASTE LANDFILL MANAGEMENT OPTIONS
FT. DEVENS, MASSACHUSETTS

OPTION	LANDFILL MANAGEMENT	COST	LAND RE-USE POTENTIAL	PUBLIC ACCEPTANCE
1. • Cap In Place: 9, 11, 40 • Off-Site Disposal: Bundle (6, 12, 13, 41)	Results in four separate landfills (9, 11, 40, SHL) to be managed.	\$9.4 M	Offers least amount of potential re-use area (9, 11, 40, and SHL is restricted).	Probably least favored.
2. • Consolidate Near SHL: 9, 11, 40, Bundle	Results in one landfill area (SHL) to be managed.	\$12.4 M	Offers most potential re-use area (only SHL restricted).	Probably most favored.
3. • Cap In Place: 11 • Consolidate at NPL: 9, 40, Bundle	Results in three landfills (9, 11, SHL) to be managed.	\$12.1 M	Restricts re-use potential at 9, 11, SHL.	Probably more favored than Option 1.
4. • Consolidate at NPL: 9, 11, 40, Bundle	Results in two landfills (9, SHL) to be managed.	\$11.8 M	Restricts re-use potential at 9, SHL.	Probably more favored than Option 3.
5. • Cap In Place: 9, 11 • Consolidate Near SHL: 40, Bundle	Results in three landfills (9, 11, SHL) to be managed.	\$12.5 M	Restricts re-use potential at 9, 11, SHL.	Probably more favored than Option 1.
6. • Cap In Place: 40 • Consolidate Near SHL: 9, 11, Bundle	Results in two landfills (40, SHL) to be managed.	\$10.4 M	Restricts re-use potential at 40, SHL.	Probably more favored than Option 1.

TABLE 3
DISPOSAL AREA MANAGEMENT OPTIONS
COST DETAIL

OPTION	SA 9 \$6000	AOC 11 35000	AOC 40 100000	Bundle 20000	Volume Total	\$ Total
1 Cap in place, cy	56,000	35,000	100,000	0	191,000	
CIP \$	\$2,050,000	\$1,740,000	\$2,437,000	\$0		\$6,227,000
Sed/drum removal	\$0	\$0	\$1,323,000	\$0		\$1,323,000
Excav volume, cy	0	0	0	20,000	20,000	
Excav. & Haul	\$0	\$0	\$0	\$0		\$0
Site Restor. & Cont.	\$0	\$0	\$0	\$226,570		\$226,570
Off-site disposal, cy	0	0	0	20,000	20,000	
Excav, haul, dispose off:						\$1,620,320 \$9,396,890
2 Cap in place, cy	0	0	0	0	0	
CIP \$	\$0	\$0	\$0	\$0		\$0
Sed/drum removal	\$0	\$0	\$1,735,150	\$0		\$1,735,150
Excav volume, cy	56,000	35,000	100,000	20,000	211,000	
Excav. & Haul	\$456,400	\$285,250	\$815,000	\$203,000		\$1,759,650
Site Restor. & Cont.	\$634,396	\$396,498	\$1,132,850	\$226,570		\$2,390,314
Consolidate volume, cy	56,000	35,000	100,000	20,000	211,000	
Consol. \$						\$6,552,000 \$12,437,114
3 Cap in place, cy	0	35,000	0	0	35,000	
CIP \$	\$0	\$1,740,000	\$0	\$0		\$1,740,000
Sed/drum removal	\$0	\$0	\$1,735,150	\$0		\$1,735,150
Excav volume, cy	56,000	0	100,000	20,000	176,000	
Excav. & Haul	\$456,400	\$0	\$815,000	\$203,000		\$1,474,400
Site Restor. & Cont.	\$0	\$0	\$1,132,850	\$226,570		\$1,359,420
Consolidate volume, cy	56,000	0	100,000	20,000	176,000	
Consol. \$						\$5,800,000 \$12,108,970
4 Cap in place, cy	0	0	0	0	0	
CIP \$	\$0	\$0	\$0	\$0		\$0
Sed/drum removal	\$0	\$0	\$1,735,150	\$0		\$1,735,150
Excav volume, cy	56,000	35,000	100,000	20,000	211,000	
Excav. & Haul	\$456,400	\$285,250	\$815,000	\$203,000		\$1,759,650
Site Restor. & Cont.	\$0	\$396,498	\$1,132,850	\$226,570		\$1,755,918
Consolidate volume, cy	56,000	35,000	100,000	20,000	211,000	
Consol. \$						\$6,552,000 \$11,802,718
5 Cap in place, cy	56,000	35,000	0	0	91,000	
CIP \$	\$2,050,000	\$1,740,000	\$0	\$0		\$3,790,000
Sed/drum removal	\$0	\$0	\$1,735,150	\$0		\$1,735,150
Excav volume, cy	0	0	100,000	20,000	120,000	
Excav. & Haul	\$0	\$0	\$815,000	\$203,000		\$1,018,000
Site Restor. & Cont.	\$0	\$0	\$1,132,850	\$226,570		\$1,359,420
Consolidate volume, cy	0	0	100,000	20,000	120,000	
Consol. \$						\$4,600,000 \$12,502,570
6 Cap in place	0	0	100,000	0	100,000	
CIP \$	\$0	\$0	\$2,437,000	\$0		\$2,437,000
Sed/drum removal	\$0	\$0	\$1,323,000	\$0		\$1,323,000
Haul volume	56,000	35,000	0	20,000	111,000	
Excav. & Haul	\$456,400	\$285,250	\$0	\$203,000		\$944,650
Site Restor. & Cont.	\$634,396	\$396,498	\$0	\$226,570		\$1,257,464
Consolidate volume	56,000	35,000	0	20,000	111,000	
Consol. \$						\$4,400,000 \$10,362,114

Notes:

In-place cap for AOC 40 is enhanced "D" cap (i.e., composite cap).

CIP \$ include 25 % contingency, plus 30 % for health & safety, administrative, engineering, and services during construction.

Sed/drum removal includes sed/drum removal costs at CSBL plus associated wetland restoration (includes contingencies, health & safety, administrative, etc.).

Estimated waste excavation cost is \$ 2.75/cy

Estimated waste haul cost is \$ 5.40/cy for four mile distance using 20-cy trucks (applies to AOCs 9 and 11).

Estimated waste haul cost is \$ 7.40/cy for "Bundle" using 20-cy trucks (6 mile typical).

Site restoration and contingency includes site restoration plus 25 % contingency for excavation, hauling, and restoration, and 30 % for health & safety, administrative, engineering, and services during construction.

**WASTE VOLUME CALCULATIONS
SEVEN DEVENS LANDFILLS**

ABB Environmental Services, Inc.



MEMORANDUM

PROJECT: **Landfill Remediation Feasibility Study
Devens, Massachusetts**

BY: **Mike Donnelly**

DATE: **January 9, 1997**

SUBJECT: **Debris Volume at AOC 9**

Previous Debris Volume Estimates

For the draft Consolidation Landfill FS, 1995, ABB-ES estimated the debris volume of AOC 9 at 56,000 cy, based on 8 test pits conducted in 1992 and 1994. The AOC 9 landfill is a cluster of 5 areas that covers about 7.5 acres. Most of the waste was in one main 6.2 acre area. The average depth of waste was about 5 feet.

In 1996, SEA Consultants reported the results of their investigation of AOC 9 to the Massachusetts Government Land Bank. Part of the investigation included making 21 test pits, and evaluating the test pit data to re-estimate the area and volume of AOC 9. SEA reported the area at 8.5 acres, the volume at 154,000 cy, and an average depth of about 11 feet.

ABB-ES has examined the information in the SEA report and the results of all of the test pit data to date. Figure 1 of the SEA report is attached to this memo to illustrate the test pit locations. A new set of ABB-ES calculations is also attached.

Evaluation of Recent Data

Of the 5 waste areas that make up AOC 9, the smallest 4 areas contribute about 15 % of the total debris volume. The 15 % ratio applies to ABB-ESs earlier estimate and SEAs more recent estimate. After reviewing the test pit depths for the 4 smallest areas, ABB-ES agrees with SEAs reported debris area of 2.3 acres and volume of about 22,000 cy.

The largest area contains about 85 % of the debris volume and ABB-ES has looked closely at the debris depths from all test pits. Because the area is irregular, five subareas were created to facilitate volume calculations. The subareas and test pit depths are shown on the attached Figure 1. The attached

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calculations are referenced to the subarea and its average debris depth. For the 6.2 acre area, the debris volume is 80,000 cy and the average depth is about 8 feet.

The total debris volume for the entire AOC 9 is 102,000 cy that, with a contingency factor, becomes 112,000 cy.

MEMORANDUM

**PROJECT: Landfill Remediation Feasibility Study
Devens, Massachusetts**

BY: Mike Donnelly

DATE: January 9, 1997

SUBJECT: Landfill Debris Volumes

Summary of Debris Volumes

This memorandum summarizes debris volumes in the seven landfills of the Landfill Remediation Feasibility Study in the tabulation below. Landfill information includes volumes that help estimate the cost of excavating, hauling and placing debris in a new consolidation landfill, and areas that help estimate the cost of capping in place. Some of the landfills have new volumes revised for this report using recent data. New calculations for the revised volumes at each landfill are included in this appendix as listed below. Other debris volumes presented here are taken from several documents, and the sources of the volumes are listed separately below.

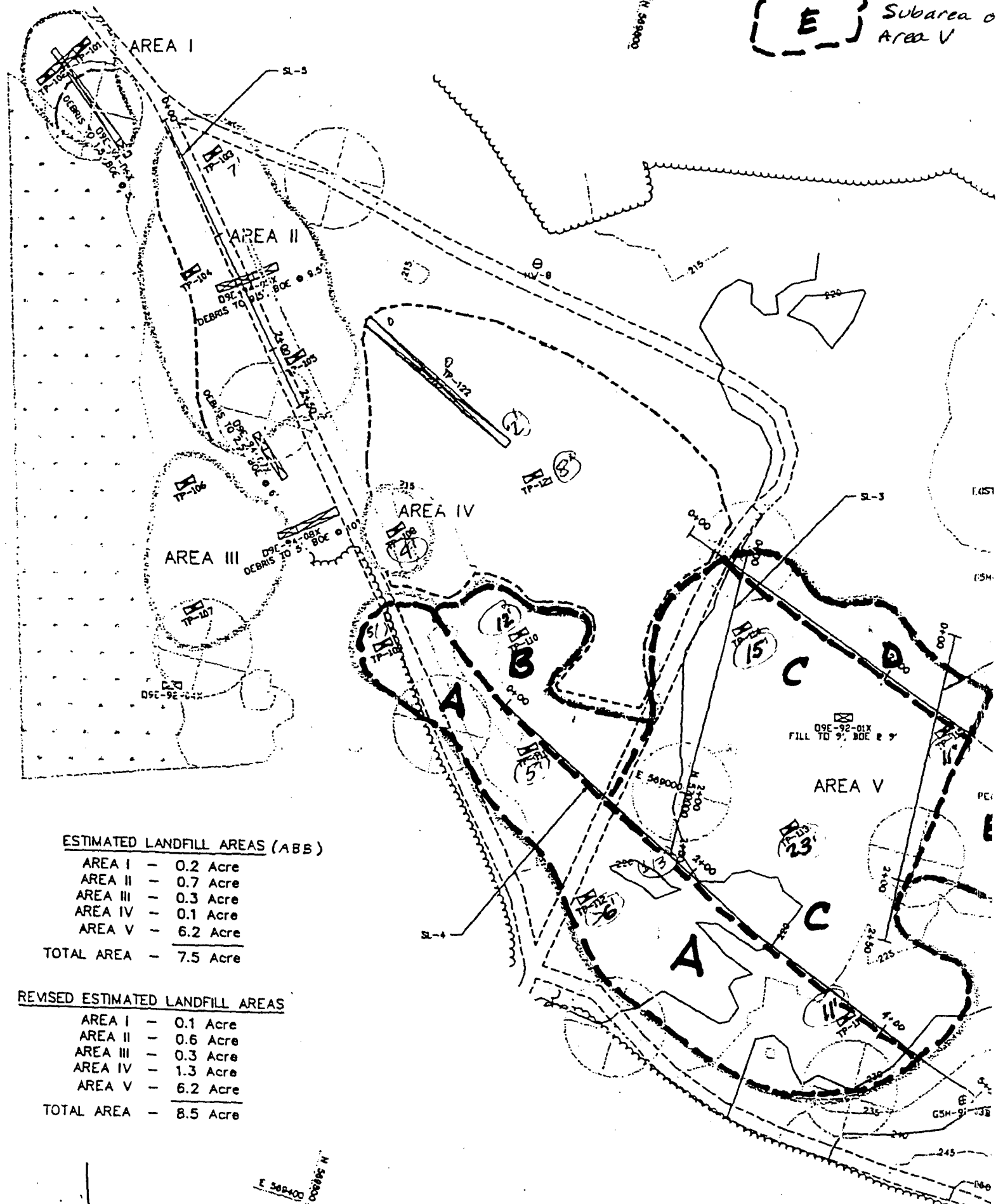
LANDFILL DEBRIS VOLUMES			
Landfill	Area (acres)	Average Depth (ft)	Volume (cy)
SA 6	0.2	3	500
SA 12	0.5	12	8,700
SA 13	0.6	10	10,000
AOC 41	0.2	5	1,500
AOC 9	8.5	8	112,000
AOC 11	2.5	9	35,000
AOC 40	4.1	17	110,000

Sources of Debris Volumes

All of the landfill volumes were reported in the Draft Consolidated Landfill Feasibility Report, ABB-ES 1996. The source document for the landfill volumes and test pit logs are tabulated below. However, revised landfill volumes are created in this Landfill Remediation FS for AOC 9 and 40, and the volume documentation is included as part of this appendix. Volume calculations for the consolidation landfill are part of this appendix also.

Landfill	Source of Debris Volume	Location of Test Pit Logs
SA 6	ABB-ES 1994, Data Package to USACE, December 23, 1994	ABB-ES 1994, Data Package to USACE, December 23, 1994
SA 12	ABB-ES 1994, Data Package to USACE, December 23, 1994	ABB-ES 1995, Revised Final Groups 2 & 7 Site Investigation
SA 13	ABB-ES 1994, Data Package to USACE, December 23, 1994	ABB-ES 1995, Revised Final Groups 2 & 7 SI
AOC 9	ABB-ES 1997, Landfill Remediation FS, Appendix B-2	ABB-ES 1996, Revised Final SI Report- Groups 3, 5 & 6
AOC 11	ADL 1994, Draft RI AOC-11 Debris Disposal	ADL 1994, Draft RI AOC-11 Debris Disposal
AOC 40	ABB-ES 1997, Landfill Remediation FS, Appendix B-3	ABB-ES 1994, Final FS AOC 40
AOC 41	ABB-ES 1994, Job file notebook, November 7, 1994	ABB-ES 1995, Revised Final Groups 2 & 7 SI
Consolidation landfill	ABB-ES 1997, Landfill Remediation FS, Appendix B-4	ABB-ES 1996, Draft Consolidated Landfill FS

E Subarea o
Area V



AREA I	-	0.2 Acre
AREA II	-	0.7 Acre
AREA III	-	0.3 Acre
AREA IV	-	0.1 Acre
AREA V	-	6.2 Acre
TOTAL AREA	-	7.5 Acre

AREA I	-	0.1 Acre
AREA II	-	0.6 Acre
AREA III	-	0.3 Acre
AREA IV	-	1.3 Acre
AREA V	-	6.2 Acre
TOTAL AREA	-	8.5 Acre

note

of



	VOLUMES
AREA I	242 cy (SEA)
AREA II	9,284 (SEA)
AREA III	3,065 (SEA)
AREA IV	8914 (SEA)
AREA V	80,000 (ABB) calcs attached
	say 102,000 cy
	+10% 10,000
	112,000 cy

LEGEND

- EXISTING TREE LINE
- APPROXIMATE EXISTING BORING LOCATION
- APPROXIMATE EXISTING TEST PIT LOCATION
- APPROXIMATE EXISTING MONITORING WELL LOCATION
- EXISTING GRAVEL ROAD
- ESTIMATED LIMITS OF WASTE (ABB FEASIBILITY STUDY)
- ADDITIONAL ESTIMATED LIMITS OF WASTE (S E A, 1996)
- EXISTING CONTOUR
- EXISTING WETLAND AREA
- PROPOSED TEST PIT LOCATION
- REQUIRED SURVEY LAYOUT LOCATIONS
- GEOPHYSICAL LINES

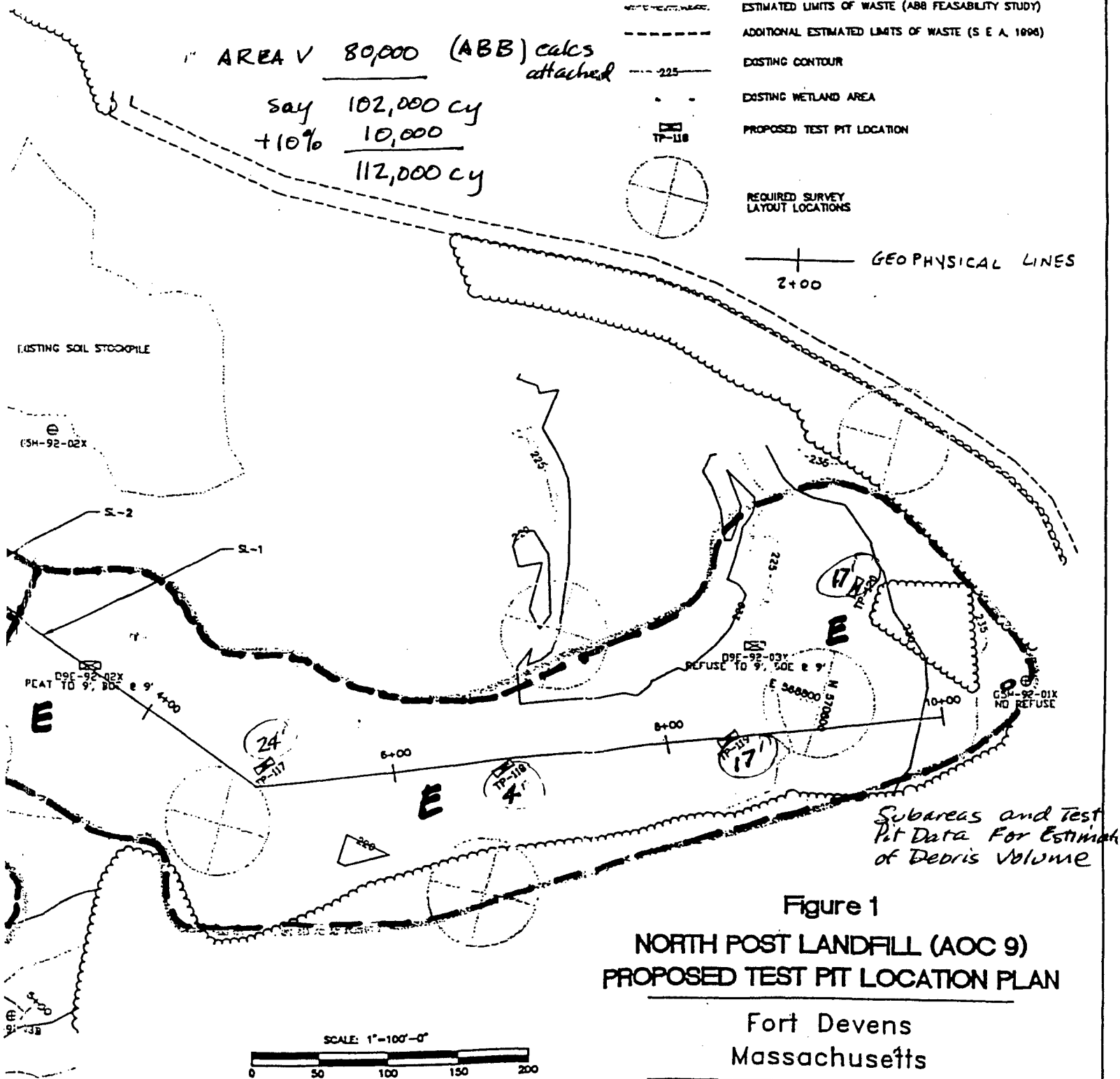


Figure 1
NORTH POST LANDFILL (AOC 9)
PROPOSED TEST PIT LOCATION PLAN

Fort Devens
Massachusetts

SEA Consultants Inc.
Engineers/Architects

PROJECT

LAKE III REMEDIATION FS
VOLUME ESTIMATE RDC 9

COMP. BY

KAD

CHK. BY

MJS

JOB NO.

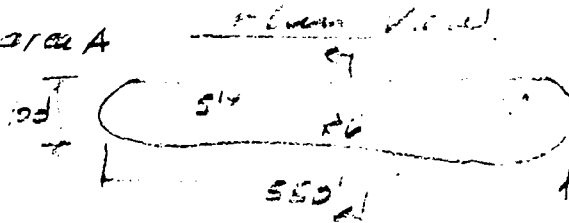
7-2-92

DATE

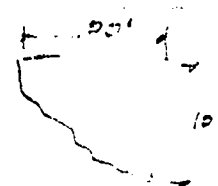
JAN 20, 1997

Refer to SEE Figure 1 - AREA V

Subarea A



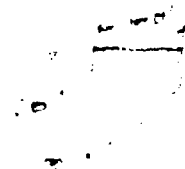
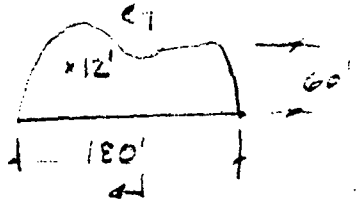
SECTION



VOLUME

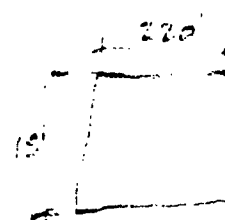
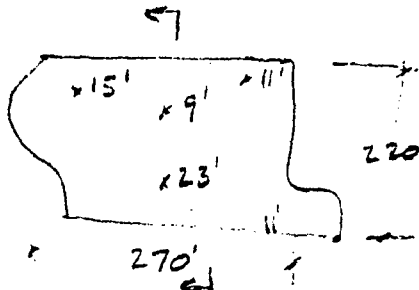
$$\frac{1}{2} (50 + 10) \times 100 \times 10 = 275,000 \text{ cf}$$

Subarea B



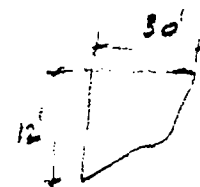
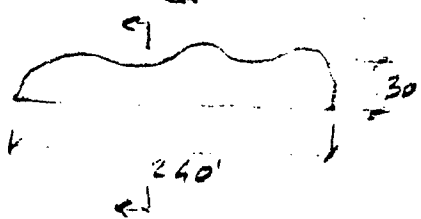
$$\frac{1}{2} (10 + 10) \times 60 \times 12 = 54,000 \text{ cf}$$

Subarea C



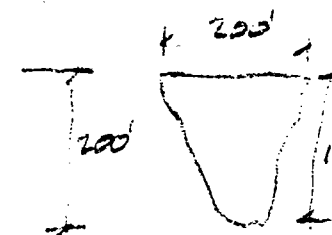
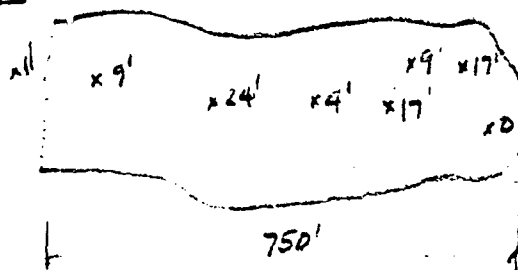
$$270 \times 15 \times 220 = 89,700 \text{ cf}$$

Subarea D



$$\frac{1}{2} (30 + 12) \times 240 \times 12 = 43,200 \text{ cf}$$

Subarea E



$$\frac{1}{2} (200 + 12) \times 750 \times 12 = 902,000 \text{ cf}$$

Total Subareas = 2,163,000 cf

≈ 80,000 cy

MEMORANDUM

**PROJECT: Landfill Remediation Feasibility Study
 Devens, Massachusetts**

BY: Mike Donnelly

DATE: January 9, 1997

SUBJECT: Debris Volume at AOC 40

Previous Debris Volume Estimates

For the Final Feasibility Study Report, Cold Spring Brook Landfill Operable Unit, ABB-ES estimated the debris volume of AOC 40 at 100,000 cy. The estimate was calculated by cross-section areas using existing grades and an assumed bottom elevation. The calculations produced a volume of 86,000 cy. An extra 10,000 cy (equal to 2 feet of depth) was added as a contingency. The total was rounded to 100,000 cy.

In 1996, SEA Consultants reported the results of their investigation of AOC 40 to the Massachusetts Government Land Bank. The investigation included 8 test pits, and an evaluation of the area and volume of AOC 40. SEA averaged the test pit depths and adjusted ABB-ES' volume upward to 160,000 cy. This increase is too high because the thickness of the debris varies over the site, and the average of the test pit depths does not represent the average for the entire site.

Revised Debris Estimate

SEA's test pit depths indicate that the actual bottom of debris is lower than previously assumed. The calculated increase in volume adds about 17,000 cy to the initial calculation of 86,000 cy. The revised estimate, 103,000 cy, is rounded up to 110,000 cy as a contingency.

MEMORANDUM

PROJECT: Landfill Remediation Feasibility Study
Devens, Massachusetts

BY: Mike Donnelly

DATE: January 9, 1997

SUBJECT: Consolidation Landfill Volumes

Summary of Consolidation Landfill Volumes

The estimated volumes of debris placed in the Consolidation Landfill for the various Alternatives are summarized below. A total landfill volume is presented that includes daily cover and final cover. The daily cover volume is equal to 10 percent of the debris, and the final cover volume is based on the landfill area and a thickness of 5 feet. The five feet includes the minimum four foot cap thickness plus one extra foot for grading.

CONSOLIDATION VOLUMES (cy)

	Alternatives 4 & 5	Alternative 6	Alternative 8	Alternative 9
SA 6			500	500
SA 12			9,000	9,000
SA 13			10,000	10,000
AOC 41			1,500	1,500
AOC 9	112,000	112,000	112,000	112,000
AOC 11		35,000		35,000
AOC 40	<u>110,000</u>	<u>110,000</u>	<u>110,000</u>	<u>110,000</u>
Total Debris	222,000	257,000	243,000	278,000
Daily Cover (10%)	22,000	26,000	24,000	28,000
Final Cover (5 ft)	<u>60,000</u>	<u>60,000</u>	<u>60,000</u>	<u>60,000</u>
Total LF Volume	304,000	343,000	327,000	366,000

Consolidation Landfill Layout

The footprint of the Consolidation Landfill maximizes the available land between the Shepley's Landfill Phase II Closure on the West, the Reservation Boundary on the East and Plow Shop Pond to the

North. Set backs are 250 feet from the pond, 100 feet from the Reservation Boundary, and 50 feet from the edge of the Shepley's Landfill cap. The foot print is slightly irregular but the dimensions approximate a square 550 feet by 550 feet at existing grade. At the center of the landfill, existing grade is elevation 238 and the top of the composite liner is at elevation 230. Groundwater at the center of the landfill is at elevation 220.

Maximum sideslopes of the landfill, above and below grade, are 3 horizontal to 1 vertical. For volume calculations, the sideslope has a 10 foot wide bench every vertical rise of 15 feet. A minimum top slope is 5 %. The composite liner slopes downward at a 2% grade towards the northeast corner.

Attached are volume calculations of the landfill at increasing height intervals. These volumes are plotted on a volume versus elevation curve. The landfill height for the various alternatives is determined by plotting the landfill volume on the curve and reading the corresponding elevation.. The minimum landfill height is Alternative 4 at elevation 270, and the maximum landfill height is Alternative 9 at elevation 290.

PROJECT LF consolidation FT. DEVERDS	COMP. BY LT	JOB NO. 8712-04
	CHK. BY AWD	DATE 1/10/97

VOLUME Calculations:

Assumptions:

- Base elev. (GD) = 238'
- 3:1 slopes, benches @ 15'
- Ave Area @ base = 550 x 550' = 302,500 ✓
- $V = \frac{1}{3} (A_1 + A_2 + \sqrt{A_1 A_2}) \times H / 27$

Grade	Ave Dimension	Area	Volume
238	550 x 550	302,500	
293	460 x 460	211,600 ✓	142,055 ✓
293	440 x 440	193,600	
			87,055
268	350 x 350	122,500 ✓	
268	330 x 330	108,900	
			45,500
283	240 x 240	57,600 ✓	
283	220 x 220	48,400	
			17,388
298	130 x 130	16,900	

Below grade → Ave elev. = 230
 → 8' layer
 - 3:1 slopes

238	555 x 550	302,500	
230	502 x 502	252,004	82,035

PROJECT <i>LF Consolidation</i> <i>Ft DENNIS</i>	COMP. BY <i>NT</i>	JOB NO. <i>8712-04</i>
	CHK. BY <i>(signature)</i>	DATE <i>1/10/97</i>

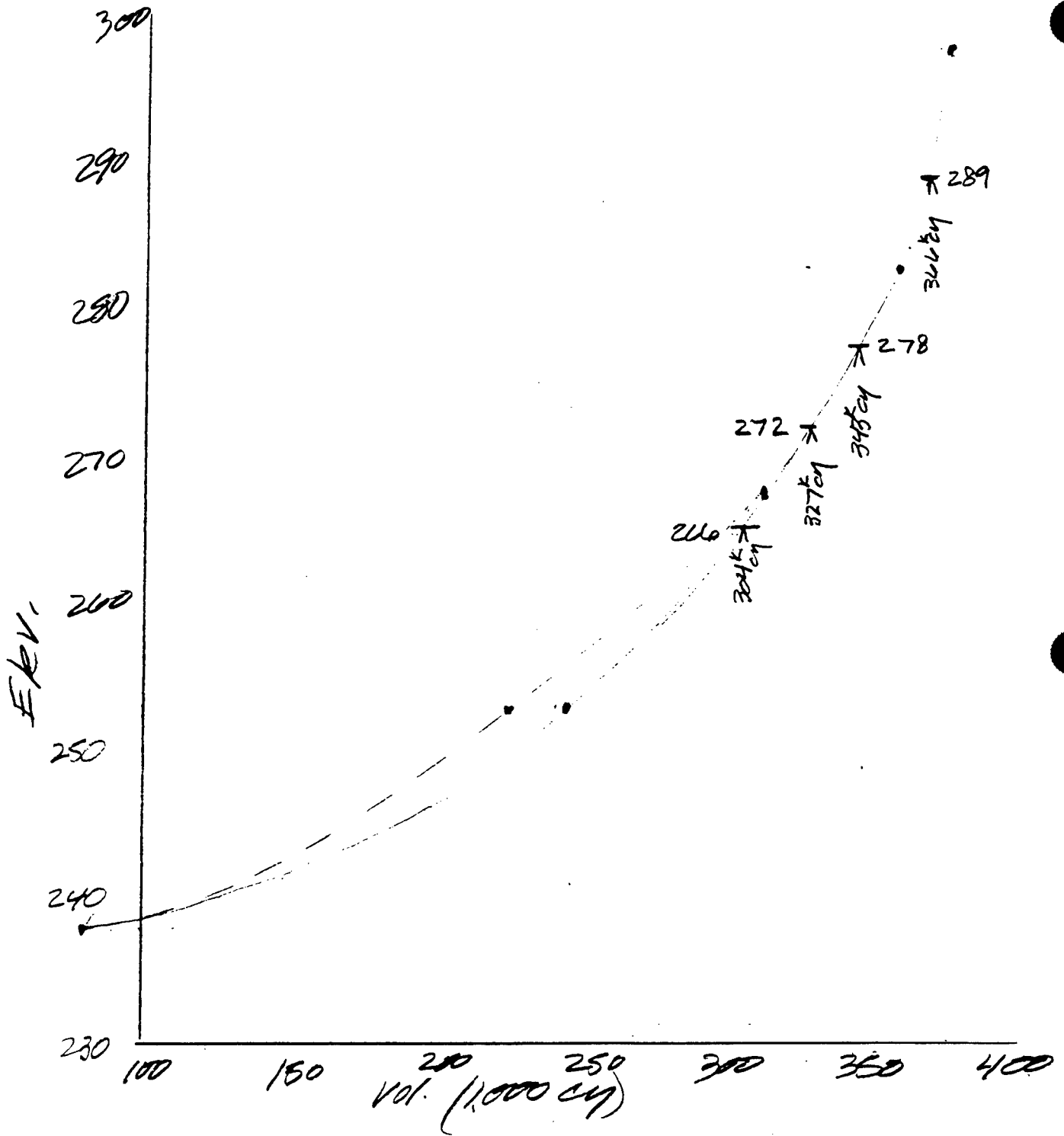
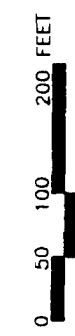
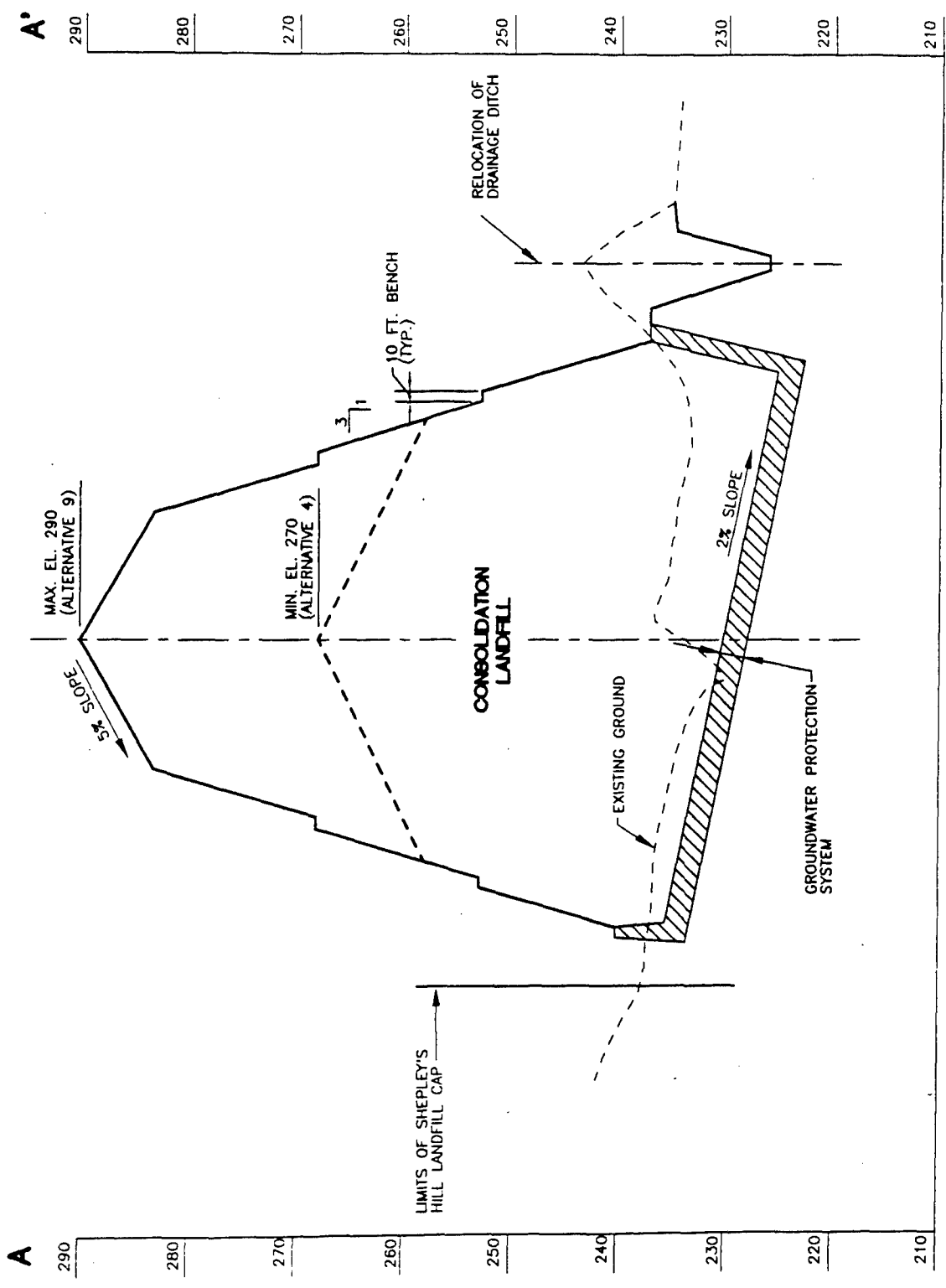




ABB Environmental Services, Inc.



SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'

FIGURE 8-9
CONSOLIDATION LANDFILL SECTION
CONSOLIDATION LANDFILL FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

WETLANDS DELINEATION AT AOC 41

ABB Environmental Services, Inc.



Inter-Office Correspondence

TO: Mark Stelmack
FROM: John A. Bleiler and Nancy E. Roka
DATE: July 7, 1995
PROJECT NUMBER: 08712.04 OFI
SUBJECT: Wetland Delineation for Study Area 41
Fort Devens, MA

1.0 Introduction

This internal memorandum summarizes the results of wetlands identification and delineation activities conducted at Study Area (SA) 41 at Fort Devens.

2.0 Wetland Characterization

On June 29, 1995 ABB-ES ecologists identified and delineated two inland wetland resource areas at SA 41. Wetlands were identified and delineated pursuant to federal (Section 404 of the Clean Water Act) and state regulations (Massachusetts Wetlands Protection Act (M.G.L. c. 131, s.40) and Regulations (310 CMR 10.00)).

The Clean Water Act defines wetlands as:

"..areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." (40 CFR 230.3)

All federally jurisdictional wetlands were identified and delineated as specified in the 1987 *Corps of Engineers Wetlands Delineation Manual* (Final Report, U.S. Department of the Army). Criteria for vegetation, hydrology, and soils must be met in order for an area to be considered a federal jurisdictional wetland.

Delineation under the Massachusetts regulations was performed according to the following definition:

"The boundary of Bordering Vegetated Wetlands is the line within which 50 percent or more of the vegetational community consists of the wetland plant species identified in the Act" (310 CMR 10.55).

Each identified wetland area was delineated with sequentially numbered wetland delineation flagging. The following text briefly summarizes our findings at SA 41. If required to meet your reporting or permitting needs, additional information --including field logbooks and field data forms-- are also available.

SA 41 is located on South Post, due east of the impact area in between an access road and New Cranberry Pond (approximately 75 feet to the south). The site is less than an acre in size and consists of landfill debris deposited upgradient of a basin, which may be a former borrow pit. Although New Cranberry Pond is nearby, a berm supporting upland vegetation exists between the two areas; no drainage pathways connecting the pond with the SA41 basin were observed.

Two wetland areas were identified at SA41: the basin downgradient of SA 41 and the border of New Cranberry Pond. The basin was evaluated for wetland hydrology, hydric soils, and hydrophytic vegetation. The border between upland and New Cranberry Pond is distinctly marked by topography and wetland vegetation, therefore, vegetation and hydrology were the primary criteria used to delineate this wetland boundary.

2.1 SA 41 Basin

Vegetation within the basin includes several hydrophytic species, as well as some transitional upland species. Within the wooded overstory, red maple (*Acer rubrum*) and swamp white oak (*Quercus bicolor*) are present. The sparse shrub layer consists of several saplings of the tree species listed above, as well as steplebush (*Spiraea tomentosa*), red oak (*Quercus rubra*), and northern arrowwood (*Viburnum recognitum*). Herbaceous growth is sparse, but is dominated by various sedges (*Carex lurida*, *Carex stricta*) with other species bordering the edge of the depression including spotted Joe-Pye weed (*Eupatorium maculatum*), black cherry (*Prunus serotina*), quaking aspen (*Populus tremuloides*), and royal fern (*Osmunda regalis*).

Water-stained leaves were observed in the SA 41 basin, indicating the presence of wetland hydrology. Although no standing water was present during the field visit, it is possible that during the spring and early summer, this basin may provide vernal pool habitat. No other signs of wetlands hydrology were observed at SA 41.

Hydric soils were identified in the lowest area of the depression under 1 to 2 inches of stained leaf litter. The top three inches were a poorly-drained dark brown sandy silty loam overlying well-drained medium sand with numerous iron depletions (gleyed) and concretions down to at least 22 inches. The presence of mottles indicates that the water table is fluctuating at or near the surface during a significant portion of the year.

The SA 41 basin meets all three criteria for classification as a federally jurisdictional wetland: vegetation is dominated by >50% hydrophytes, hydric soils are present, and signs of wetland hydrology are present.

Since the SA 41 basin does not border a creek, river, stream, pond, or lake, it is not classified as a state-jurisdictional Bordering Vegetated Wetland (BVW). However, under the Massachusetts wetland regulations, the basin area at SA 41 may be defined as an "Isolated Land Subject to Flooding" (ILSF). The definition of ILSF under 310 CMR 10.57 (2)(b) is as follows:

"An Isolated Land Subject to Flooding is an isolated depression or closed basin without an inlet or an outlet. It is an area which at least once a year confines standing water to a volume of at least ¼ acre-feet and to an average depth of at least six (6) inches."

This definition of ILSF is dependent on an estimate of the volume of water the depression can hold, as determined by engineering calculations. Therefore, ABB-ES ecologists did not determine whether or not state jurisdictional wetlands are present at SA 41 (i.e., whether or not the site contains ILSF).

A transect was established perpendicular to the SA 41 wetland boundary, and data regarding the hydrology, soils, and vegetation in the upland area and the bottom of the basin were recorded on U.S. Army Corps of Engineer (USACE) data forms. The wetland at SA 41 was delineated with orange surveyor's flagging labeled "A1" to "A6".

2.2 New Cranberry Pond Border

The wetland boundary between upland and New Cranberry Pond is well-defined by topography and vegetation. A joint federal/state wetland delineation line was established at this portion of the site. The boundary was marked using pink surveyor's flagging labeled "B1" to "B8 end".

Various wetland plant species used to demarcate the wetland boundary include tussock sedge (*Carex stricta*), knotweed/smartweed (*Polygonum* spp.), blue-joint (*Calamagrostis canadensis*), silky dogwood (*Cornus amomum*), tall meadow rue (*Thalictrum polygamum*), sedges (*Carex* spp., *Carex lurida*), speckled alder (*Alnus rugosa*), reed canary grass (*Phalaris arundinacea*), northern arrowwood, marsh St. Johnswort (*Hypericum virginicum*), soft rush (*Juncus effusus*), common winterberry (*Ilex verticillata*), honeysuckle (*Lonicera* sp.), sensitive fern (*Onoclea sensibilis*), yellow loosestrife (*Lysimachia terrestris*), and fowl meadow grass (*Glyceria* spp.).

Upland species also used to define the wetland boundary include timothy grass (*Phleum pratense*), bush clover (*Lespedeza capitata*), daisy fleabane (*Erigeron annuus*), yellow clover (*Trifolium agrarium*), big tooth aspen (*Populus grandidentata*), honeysuckle, black oak (*Quercus velutina*), white pine (*Pinus strobus*), European buckthorn (*Rhamnus frangula*), quaking aspen, goldenrod (*Solidago* spp.), grey birch (*Betula populifolia*), black cherry, bristly dewberry (*Rubus hispidus*), tartarian honeysuckle (*Lonicera tartarica*), and common buckthorn (*Rhamnus cathartica*).

3.0 Summary

The SA 41 basin is classified as a federal jurisdictional wetland, although the hydrologic indicators were weak. Although SA 41 is not a BVW, it is a well defined basin and may qualify as a state jurisdictional ILSF. The boundary delineated by wetland flags A1 through A6 represents the federal wetland boundary at SA 41.

The area along New Cranberry Pond classifies as both a federal and state jurisdictional wetland, and is delineated by wetland flags B1 through B8 end.

With the exception of ILSF, the Massachusetts Wetlands Protection Act provides a 100-foot buffer zone outside of the above-described wetland resource areas. Any activity within the 100-foot buffer zone must not destroy or impair any of these protected wetlands. In addition, land at SA 41 within the 100-year floodplain elevation is considered to be Bordering Land Subject to Flooding under the Massachusetts Wetlands Act. This resource area does not have a 100-foot buffer zone, but is also subject to protection.

Please don't hesitate to contact either of us if you have questions regarding wetlands at the landfill site. We would appreciate the opportunity to review the site plan.

cc: file

EDGE OF WASTE

NA

↑ N

--- = uncharted delineated boundary
- - - = distance between P and fixed object (i.e. monitoring well)
> = direction reading was taken

41M-93-04X
41M-93-05X

A1 A2 A3 A4 A5 A6

115' 330° NW

155' SE

110° SE

36'

110° SE

18'

135° NE

42'

160° SW

61'

95° ESE

23' 110° SE

33' 135° SE

75'

95° ESE

61'

95° ESE

61'

95° ESE

61'

95° ESE

61'

95° ESE

61'

95° ESE

61'

95° ESE

61'

Fig 1

NEW CRANBERRY POND

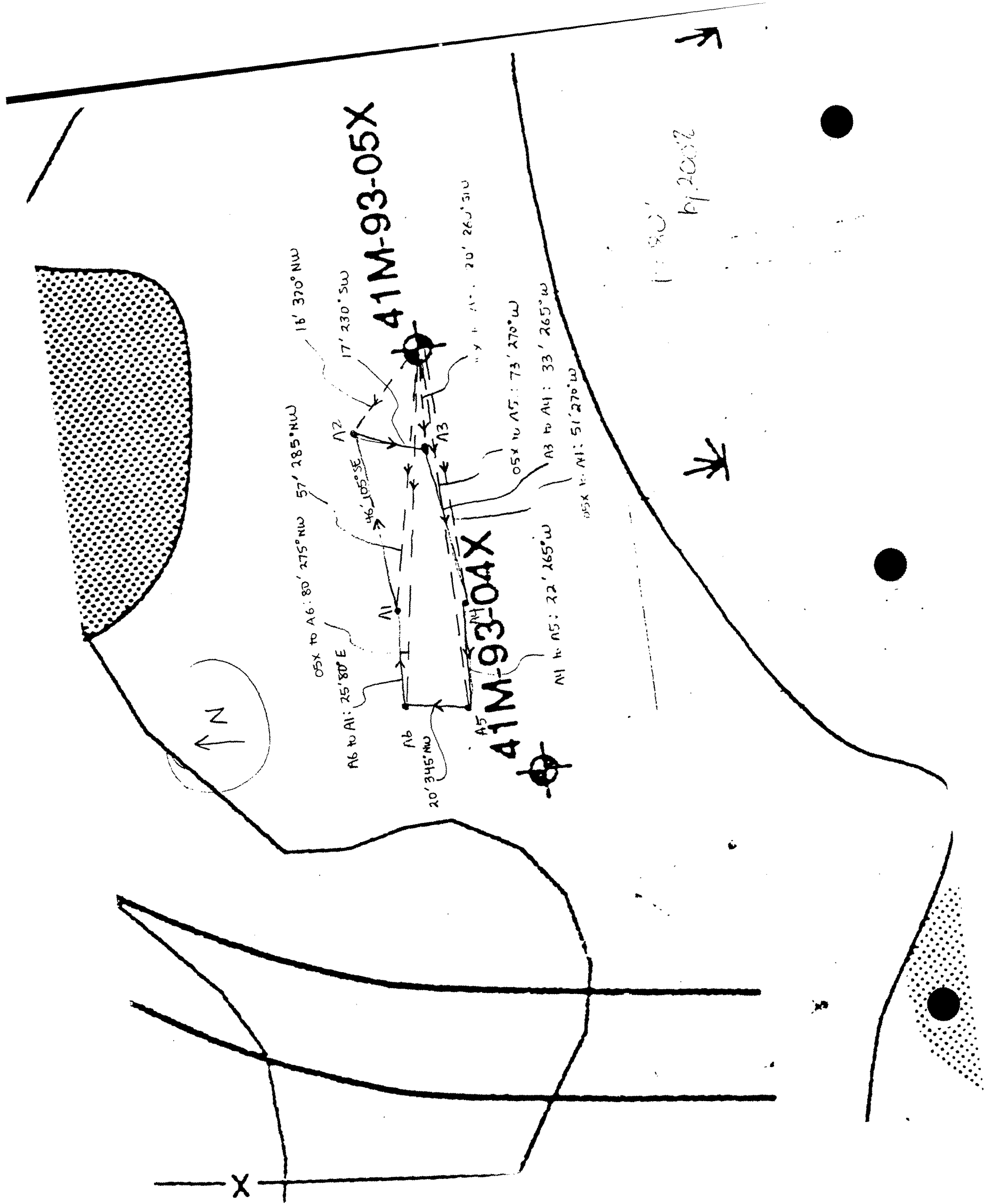




ABB Environmental Services, Inc.

511 Congress Street/P.O. Box 7050 Portland, Maine 04112
(207) 775-5401

MEMORANDUM

PROJECT NO.: 8712-04 DATE: January 14, 1997
CLIENT: U.S. Army Corps of Engineers
PROJECT DESCRIPTION: Ft. Devens - Landfill Remediation - Area of Contamination 41
TO: Mark Stelmack
FROM: Mark Peters
SUBJECT: "Isolated Land Subject To Flooding" Calculations for AOC 41 Depression

Attached are stormwater calculations to determine if the depression located at Area of Contamination 41 meets the definition of an "Isolated Land Subject to Flooding" (ILSF). The definition of an ILSF under 310 CMR 10.57 (2)(b) is as follows:

"An Isolated Land Subject to Flooding is an isolated depression or closed basin without an inlet or outlet. It is an area which at least once a year confines standing water to a volume of at least 1/4 acre-feet and to an average depth of at least six (6) inches."

The calculations were conducted using HydroCAD, a computer software program which utilizes TR-55 and TR-20 methods developed by the U.S. Soil Conservation Service. The volume and depth of standing water in the depression at AOC 41 were calculated for a 1-year, 24-hour storm event (2.6 inches of rain). From well boring logs, a Hydrologic Soil Group between A and B was used to determine the runoff curve number (CN) of 55 with wooded cover for the contributing drainage area. A CN of 98 (nearly impervious) was used for the identified wetland area located in the depression.

Based on the calculations, the depression at AOC 41 does not meet the definition of an ILSF. The total volume of water ponded during a 1-year, 24-hour storm event is only 0.01 acre-feet, which is less than the 0.25 acre-feet requirement in the regulations. In addition, the total depression storage volume (defined as the elevation at which the depression would overflow, which is elevation 226) is only 0.08 acre-feet. Although the peak depth of ponded water for this storm event is 0.7 feet, the average depth of water over the entire depression is only 1.4 inches, which is less than the 6-inch depth requirement in the regulations.

TYPE III 24-HOUR RAINFALL= 2.6 IN

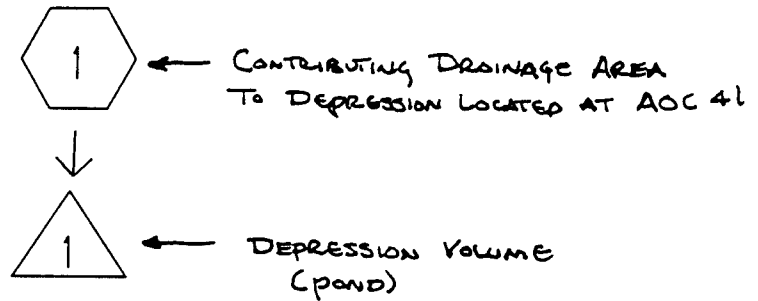
Prepared by Applied Microcomputer Systems

14 Jan 97

HydroCAD 4.52 000677 (c) 1986-1996 Applied Microcomputer Systems

WATERSHED ROUTING

=====



TYPE III 24-HOUR RAINFALL= 2.6 IN

Prepared by Applied Microcomputer Systems

14 Jan 97

HydroCAD 4.52 000677 (c) 1986-1996 Applied Microcomputer Systems

RUNOFF BY SCS TR-20 METHOD: TYPE III 24-HOUR RAINFALL= 2.6 IN, SCS U.H.

RUNOFF SPAN = 5-20 HRS, dt= .10 HRS, 151 POINTS

SUBCAT NUMBER	AREA (ACRE)	Tc (MIN)	--GROUND COVERS (%CN)--	WGT'D CN	C	PEAK (CFS)	Tpeak (HRS)	VOL (AF)
1	.43	8.6	9%98 91%55	59	-	.03	12.35	.01

WOODS w/ FAIR COVER AND HYDROLOGIC SOIL
GROUP (HSG) OF A TO B.

WETLAND AREA (≈ EL. 2250) - ASSUMED NEARLY IMPERVIOUS

TYPE III 24-HOUR RAINFALL = 2.6 IN

Prepared by Applied Microcomputer Systems

14 Jan 97

HydroCAD 4.52 000677 (c) 1986-1996 Applied Microcomputer Systems

POND ROUTING BY STOR-IND METHOD

POND NO.	START ELEV. (FT)	FLOOD ELEV. (FT)	PEAK ELEV. (FT)	PEAK STORAGE (AF)	----- Q _{in} (CFS)	PEAK FLOW Q _{out} (CFS)	----- Q _{pri} (CFS)	Q _{sec} (CFS)	---Q _{out} --- ATTN. (%)	LAG (MIN)
1	223.8	226.0	224.5	.01	.03	0.00			100	458.8

Peak Storage Volume for a 1-year, 24-hour storm event is << 0.25 Acre-Feet (AF)

Peak depth of standing water is $224.5 - 223.8 = 0.7'$
 $0.7' (8.4")$ is peak depth, But Average depth of standing water is:

$$\text{AVE. DEPTH} = \frac{\text{PEAK STORAGE VOL.}}{\text{DEPRESSION AREA}} \left\{ \begin{array}{l} \approx \text{ELEV. 226 is point} \\ \text{at which depression} \\ \text{would overflow} \end{array} \right.$$

$$\text{AVE. DEPTH} = \frac{(43560 \frac{\text{SF}}{\text{ACRE}} \times 0.01)}{3790 \text{ SF (SGE PAGE 5)}} = 0.115' \approx 1.4''$$

$$\underline{\underline{1.4'' < 6.0''}}$$

TYPE III 24-HOUR RAINFALL= 2.6 IN

Prepared by Applied Microcomputer Systems

14 Jan 97

HydroCAD 4.52 000677 (c) 1986-1996 Applied Microcomputer Systems

SUBCATCHMENT 1

AOC 41 DEPRESSION

PEAK= .03 CFS @ 12.35 HRS, VOLUME= .01 AF

ACRES	CN
.04	98
.39	55
.43	59

WETLAND DEPRESSION
WOODS (FAIR - HSG A/B)

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 2.6 IN
SPAN= 5-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
TR-55 SHEET FLOW	Segment ID: a	
Woods: Light underbrush n=.4 L=55' P2=3.1 in s=.07 '/'		8.2
SHALLOW CONCENTRATED/UPLAND FLOW	Segment ID: b	
Unpaved Kv=16.1345 L=50' s=.24 '/' V=7.9 fps		.1
SHALLOW CONCENTRATED/UPLAND FLOW	Segment ID: c	
Unpaved Kv=16.1345 L=75' s=.07 '/' V=4.27 fps		.3

Total Length= 180 ft Total Tc= 8.6

TYPE III 24-HOUR RAINFALL= 2.6 IN

Prepared by Applied Microcomputer Systems

14 Jan 97

HydroCAD 4.52 000677 (c) 1986-1996 Applied Microcomputer Systems

POND 1

AOC 41 DEPRESSION

Qin = .03 CFS @ 12.35 HRS, VOLUME= .01 AF

Qout= 0.00 CFS @ 20.00 HRS, VOLUME= 0.00 AF, ATTEN=100%, LAG= 458.8 MIN

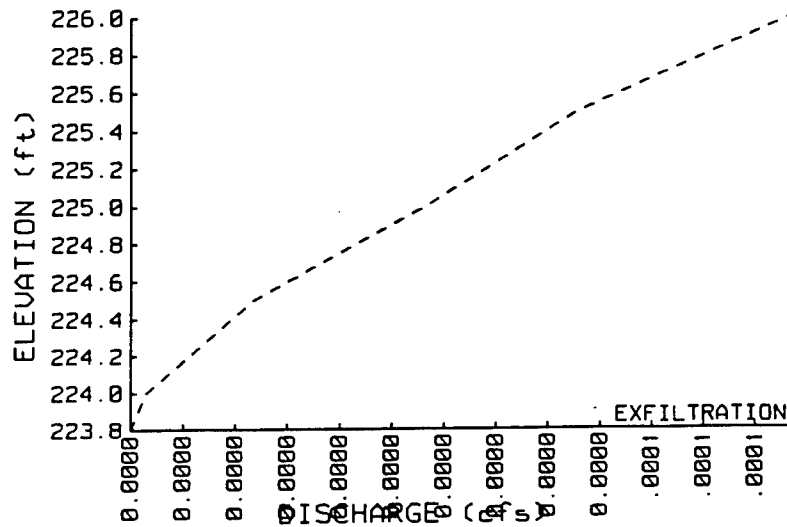
ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)	STOR-IND METHOD
223.8	0	0	0	PEAK STORAGE = 233 CF
224.0	90	9	9	PEAK ELEVATION= 224.5 FT
224.5	705	199	208	FLOOD ELEVATION= 226.0 FT
225.0	1695	600	808	START ELEVATION= 223.8 FT
225.5	2565	1065	1873	SPAN= 5-20 HRS, dt=.1 HRS
→ 226.0	3790	1589	3462	Tdet= 289.8 MIN (0 AF)

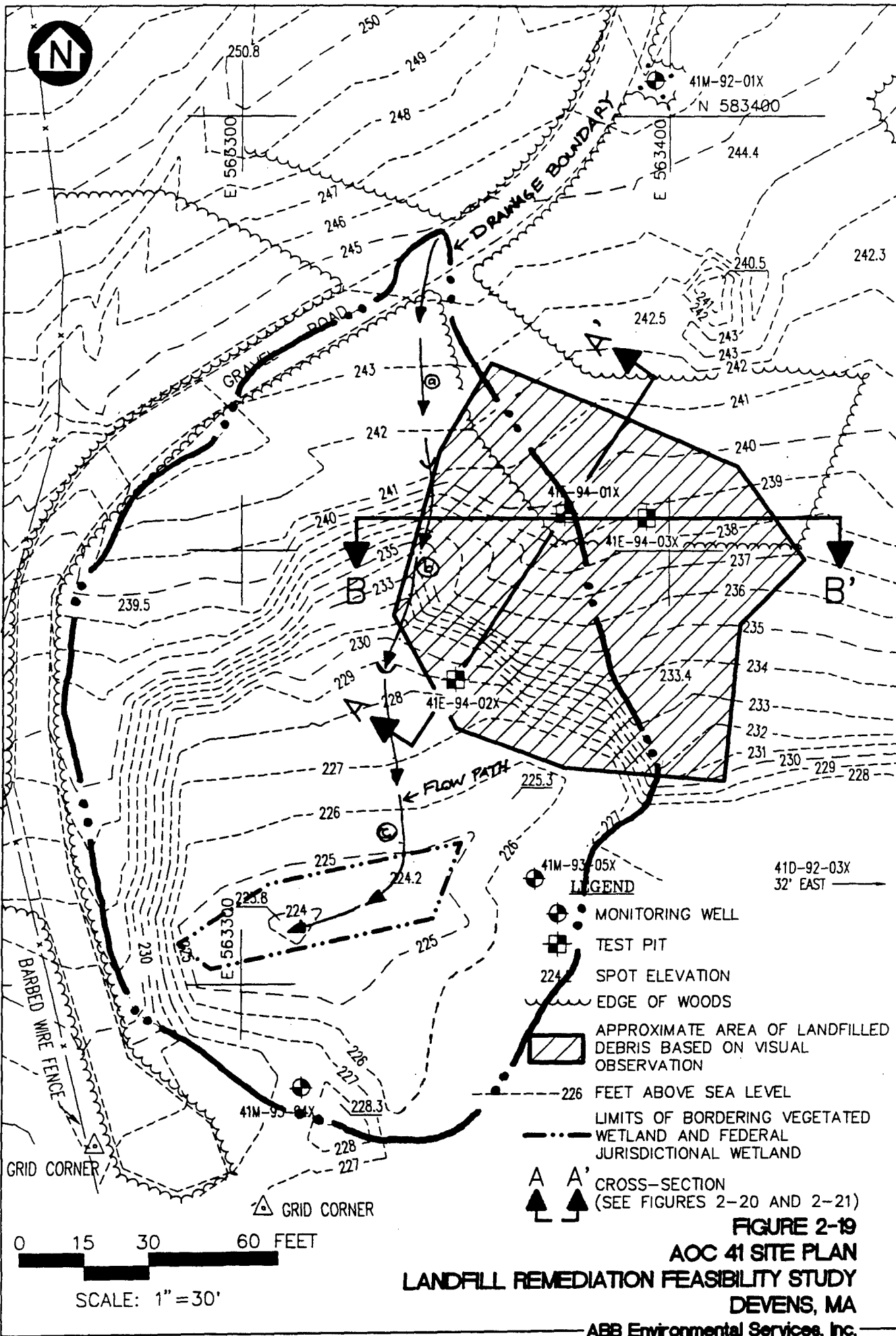
← Depression overflow Elevation

#	ROUTE	INVERT	OUTLET DEVICES
1	P	223.8'	EXFILTRATION
V= 1.E-6 FPM over SURFACE AREA			

POND 1 TOTAL DISCHARGE (CFS) vs ELEVATION

FEET	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
223.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
224.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225.8	0.00	0.00	0.00							

POND 1 DISCHARGE
AOC 41 DEPRESSION



J:\8712-04\8712F029.DWG 1/07/97

COSTS AND MATERIALS USAGE

ABB Environmental Services, Inc.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====

COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
NO FURTHER ACTION				
SA 6			\$	0
SA 12				0
SA 13				0
AOC 41				0
LIMITED REMOVAL				
AOC 11				44,000
CAP IN PLACE				
AOC 9				3,301,000
AOC 40				1,758,000
TOTAL DIRECT COSTS				\$ 5,103,000
INDIRECT COSTS				
HEALTH AND SAFETY			5.00%	\$ 255,000
LEGAL, ADMIN, PERMITTING			5.00%	255,000
ENGINEERING			10.00%	510,000
SERVICES DURING CONSTRUCTION			10.00%	510,000
TOTAL INDIRECT COSTS				\$ 1,530,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 6,633,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YEARS			\$	4,000
TOTAL ANNUAL O&M COSTS FOR AOC 9 AND 40 - 30 YEARS				72,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				13,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 953,000
TOTAL COSTS				\$ 7,586,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04
 DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====

NO FURTHER ACTION

=====

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SA 6				\$ 0
SA 12				0
SA 13				0
AOC 41				0

JOB # 8712-04
DATE 24-Jan-97

LIMITED REMOVAL AT AOC 11, DISPOSAL AT AOC 9

Page 3

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04
 DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
LIMITED REMOVAL AT AOC 11, DISPOSAL AT AOC 9				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 22,945
BACKFILL				
PURCHASED FROM OFF-SITE	625	CY	10.00	6,250
(INCLUDING 30% SWELL FACTOR)				-
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	2	DAY	1570.00	3,140
FERTILIZE, SEED, MULCH	5000	SY	0.50	2,500
				-
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				9,165
TOTAL AOC 11				\$ 44,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 9 MOB/DEMOB DESCRIPTION					QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)								
FRONT END LOADER (2 EA)				4	EA	410.00	\$	1,640
DUMP TRUCK (5 EA)				10	EA	385.00		3,850
BACK HOE				2	EA	730.00		1,460
DOZER (5 EA)				10	EA	880.00		8,800
ROLLER (5 EA)				10	EA	785.00		7,850
OFFICE TRAILER				5	MON	150.00		750
STORAGE TRAILER				5	MON	100.00		500
SET UP TRAILER				2	EA	500.00		1,000
TOILET - 2 EA				44	WK	25.00		1,100
WATER COOLER - 2 EA				44	WK	25.00		1,100
WATER				220	DAY	15.00		3,300
TELEPHONE SERVICE				5	MON	500.00		2,500
ELECTRICITY				5	MON	250.00		1,250
PICK-UP (2 EA)				10	MON	1000.00		10,000
PUMPS, TOOLS, MINOR EQUIPMENT				5	MON	500.00		2,500
SITE SUPERINTENDANT (5 MON * 210 HR/MON)				1050	MNHR	65.00		68,250
FOREMEN (5 MON * 210 HR/MON)				1050	MNHR	55.00		57,750
CLERK/TYPIST (5 MON * 168 HR/MON)				840	MNHR	25.00		21,000
TOTAL MOB/DEMOB								\$ 194,600

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 9				
SITE PREPARATION, DEBRIS EXCAVATION, & CAP CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 500 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	\$ 1,760
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT - ROLLER & OPERATOR	0.5	DAY	1570.00	785
GEOFABRIC	1100	SY	1.00	1,100
CLEAR TREES FROM SITE	3	AC	6900.00	20,700
EROSION CONTROL	700	LF	5.00	3,500
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	10	DAY	1760.00	17,600
LABORER	80	HR	33.50	2,680
TOTAL SITE PREPARATION				\$ 52,125
EXCAVATE DEBRIS AREA I, II, III, & IV & PLACE IN AREA V				
BACKHOE & OPERATOR	30	DAY	1460.00	\$ 43,800
LABORER	240	HR	33.50	8,040
DUMP TRUCK & DRIVER - 3 EA	90	DAY	770.00	69,300
DOZER & OPERATOR	30	DAY	1760.00	52,800
LABORER	240	HR	33.50	8,040
TOTAL EXCAVATE DEBRIS				\$ 181,980
CAP CONSTRUCTION				
SUBGRADE SOIL	50800	CY	10.00	\$ 508,000
TEXTURED GEOMEMBRANE	371000	SF	0.80	296,800
DRAINAGE SOIL	18200	CY	17.00	309,400
GEOTEXTILE FABRIC	371000	SF	0.10	37,100
MOISTURE RETENTION SOIL	28200	CY	10.00	282,000
VEGETATIVE SOIL	9500	CY	14.00	133,000
SPREAD & COMPACT - ROLLER & OPERATOR	132	DAY	1570.00	207,240
TOTAL CAP CONSTRUCTION				\$ 1,773,540

NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 9				
SITE RESTORATION, MONITORING WELLS, & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE RESTORATION				
DEBRIS AREA I - IV FILL MATERIAL	25250	CY	10.00	\$ 252,500
DEBRIS AREA I - IV VEGETATIVE SOIL	2700	CY	14.00	37,800
CHAIN LINK FENCE	2500	LF	13.00	32,500
12' SWING GATE	2	EA	800.00	1,600
FERTILIZE, SEED, MULCH	62000	SY	0.50	31,000
SPREAD & COMPACT - ROLLER & OPERATOR	35	DAY	1570.00	54,950
TOTAL SITE RESTORATION				\$ 410,350
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE AOC 9, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 9 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 194,600
TOTAL SITE PREPARATION				52,125
TOTAL DEBRIS EXCAVATION				181,980
TOTAL CAP CONSTRUCTION				1,773,540
TOTAL SITE RESTORATION				410,350
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				660,405
TOTAL AOC 9				\$ 3,301,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40				
SITE PREPARATION AND MOBILIZATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD SEDIMENT AREA 1				
CLEAR & GRUB LIGHT VEGETATION	0.1	AC	4300.00	\$ 430
GRADE- DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 12" THICK	360	CY	10.00	3,600
FILTER FABRIC	550	SY	1.00	550
SPREAD & COMPACT	0.5	DAY	1570.00	785
ACCESS ROAD SEDIMENT AREA 2				
CLEAR & GRUB LIGHT VEGETATION	0.1	AC	4300.00	430
GRADE- DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 24" THICK	340	CY	10.00	3,400
SPREAD & COMPACT	0.5	DAY	1570.00	785
FILTER FABRIC	550	SY	1.00	550
ACCESS ROAD FOR CAPPING - 500 LF				-
CLEAR & GRUB LIGHT VEGETATION	0.35	AC	4300.00	1,505
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 24" THICK	1450	CY	10.00	14,500
FILTER FABRIC	2000	SY	1.00	2,000
SPREAD & COMPACT	2	DAY	1570.00	3,140
PARKING AREA				
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
SEDIMENT DEWATERING PAD				-
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
LINER	10000	SF	0.60	6,000
SUMP & SUMP PUMP	1	LS	2500.00	2,500
DECON AREA - 10'x20'	3	EA	1000.00	3,000
				-
				-
				-
				-
				-
CAP MATERIALS STOCKPILE AREA				-
CLEAR & GRUB LIGHT VEGETATION	1	AC	4300.00	4,300
GRADE- DOZER & OPERATOR	2	DAY	1760.00	3,520
TOTAL THIS PAGE				\$ 61,450

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40				
SITE PREPARATION AND MOBILIZATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				\$ 61,450
MOBILIZATION				
EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	820
DUMP TRUCK	6	EA	385.00	2,310
BACKHOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
CRANE & CLAMSHELL BUCKET	2	EA	640.00	1,280
ROLLER	2	EA	785.00	1,570
FRAC TANK	4	EA	250.00	1,000
DEWATERING PUMP & HOSE	2	EA	100.00	200
OFFICE TRAILER	4	MON	150.00	600
STORAGE TRAILER	4	MON	150.00	600
TRAILER DELIVERY, SET-UP, REMOVAL	2	EA	300.00	600
TOILET - 2 EA	36	WK	25.00	900
WATER COOLER - 2 EA	36	WK	25.00	900
WATER	180	DAY	15.00	2,700
TELEPHONE SERVICE	4	MON	500.00	2,000
ELECTRICITY	4	MON	250.00	1,000
PICK-UP (2 EA)	8	MON	1000.00	8,000
OFFICE EQUIPMENT	4	MON	1000.00	4,000
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
LABORER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	33.50	5,360
CARPENTER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	48.00	7,680
ELECTRICIAN (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	50.50	8,080
SITE SUPERINTENDANT (4 MON*210HR/MON)	840	MNHR	65.00	54,600
FOREMAN (4 MON*210HR/MON)	840	MNHR	55.00	46,200
CLERK/TYPIST (4 MON*168HR/MON)	672	MNHR	25.00	16,800
				-
				-
				-
				-
TOTAL SITE PREPARATION AND MOBILIZATION				\$ 234,370

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
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 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04
 DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40 SEDIMENT REMOVAL AND DISPOSAL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CONSTRUCT SILT BARRIER AROUND CONTAMINATED AREAS	400	LF	25.00	\$ 10,000
EXCAVATE WITH CLAMSHELL 1200 CY SEDIMENTS + 1600 CY ACCESS ROADS/WORK PLATFORMS	28	DAY	1280.00	35,840
HAUL SEDIMENTS TO DEWATERING PAD (2 EA DUMP TRUCK & DRIVER)	56	DAY	770.00	43,120
LOAD DRY SEDIMENTS FOR TRANSPORTATION TO DISPOSAL AREA (FRONT END LOADER & OPERATOR)	14	DAY	825.00	11,550
LABORERS - 2 EA FOR 35 DAYS	560	MNHR	33.50	18,760
TCLP TESTING	2	SMPL	1400.00	2,800
ON-SITE STABILIZATION OF SEDIMENTS WITH SAND	600	CY	15.00	9,000
TRANSPORTATION & DISPOSAL AT AOC 9 (3 EA DUMP TRUCK & DRIVER)	42	DAY	770.00	32,340
TREATMENT OF WATER	1	LS	21800.00	21,800
PUMP WATER FROM DEWATERING PAD TO POND	28	DAY	50.00	1,400
TOTAL SEDIMENT REMOVAL AND DISPOSAL				\$ 186,610

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40				
WETLAND RESTORATION, MONITORING WELLS, DRUM REMOVAL AND DISPOSAL	QTY	UNIT	UNIT COST	TOTAL
DESCRIPTION				
WETLAND RESTORATION	1.5	AC	50000.00	\$ 75,000
MONITORING WELLS - 4" DIA x 30' DEEP	2	EA	4500.00	\$ 9,000
DRUM REMOVAL AND DISPOSAL				-
BACKHOE & OPERATOR	3	DAY	1460.00	\$ 4,380
LABORER - 2 EA, 3 DAYS	48	MNHR	33.50	1,608
TRANSPORT DRUMS TO AOC 9	3	DAY	770.00	2,310
DUMP TRUCK & DRIVER				-
TCLP TESTING OF DRUM CONTENTS	2	EA	1400.00	2,800
TOTAL DRUM REMOVAL AND DISPOSAL				\$ 11,098

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40				
CAP CONSTRUCTION, INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CAP CONSTRUCTION				
SILT FENCE ALONG TOE OF LANDFILL	1500	LF	5.00	\$ 7,500
CLEAR & GRUB SITE	4.4	AC	6900.00	30,360
LONG STICK EXCAVATOR	5	DAY	1750.00	8,750
GRADE SITE - DOZER & OPERATOR	5	DAY	1760.00	8,800
CUT LANDFILL WASTE WITH DOZER	7	DAY	1760.00	12,320
IMPORTED FILL	2500	CY	10.00	25,000
SPREAD & COMPACT WASTE & FILL	14	DAY	1570.00	21,980
SUBGRADE FILL	7100	CY	10.00	71,000
SPREAD & COMPACT SUBGRADE FILL	9	DAY	1570.00	14,130
TEXTURED GEOMEMBRANE	192000	SF	0.80	153,600
10-3 SAND DRAINAGE LAYER	9250	CY	17.00	157,250
SPREAD & COMPACT DRAINAGE LAYER	13	DAY	1570.00	20,410
GEOTEXTILE FILTER FABRIC	192000	SF	0.10	19,200
MOISTURE RETENTION LAYER	13900	CY	10.00	139,000
SPREAD & COMPACT MOISTURE RETENTION LAYER	18	DAY	1570.00	28,260
VEGETATIVE MATERIAL	4600	CY	14.00	64,400
SPREAD & COMPACT VEGETATIVE LAYER	6	DAY	1570.00	9,420
SEED, FERTILIZE, MULCH	4.4	AC	2000.00	8,800
RIPRAP	2250	CY	30.00	67,500
GUARD RAIL ALONG ROAD	1000	LF	12.50	12,500
TOTAL CAP CONSTRUCTION				\$ 880,180
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
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 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION AND MOBILIZATION				\$ 234,370
TOTAL SEDIMENT REMOVAL & DISPOSAL				186,610
TOTAL WETLAND RESTORATION				75,000
TOTAL MONITORING WELLS				9,000
TOTAL DRUM REMOVAL & DISPOSAL				11,098
TOTAL CAP CONSTRUCTION				880,180
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				351,742
TOTAL SA 13				\$ 1,758,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
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LIMITED REMOVAL AT AOC 11;
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LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL O&M COSTS				
LIMITED REMOVAL AT AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS TWICE PER YEAR FOR TWO YEARS FOR SITE RESTORATION				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
MATERIALS	1	LS	500.00	500
LABORER - 2 EA	32	MNHR	33.50	1,072

UNDEVELOPED DESIGN DETAILS ~25%

888

TOTAL ANNUAL O&M COSTS

\$ 4,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
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DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS AOC 9 CAP IN PLACE				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
FRONT END LOADER & OPER	2	DAY	825.00	1,650
LABORER - 2 EA	32	MNHR	33.50	1,072
MATERIALS	1	LS	1000.00	1,000
				-
INSPECTION - 1 DAY @ 2 MEN/DAY	16	MNHR	75.00	1,200
				-
MOWING - TRACTOR & OPERATOR	5	DAY	500.00	2,500
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
				-
				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS				\$ 27,323

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL O&M COSTS				
AOC 40 CAP IN PLACE				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS OCCURING OVER FIVE YEARS				
WETLANDS RESTORATION MONITORING (5 YEARS)				
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	\$ 2,400
BIOMONITORING, BIENNIALY				-
FOR 5 YEARS	0.4831	LS	15000.00	7,246
				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	2500.00	435
				-
TOTAL ANNUAL O&M COSTS FOR 5 YEAR ACTIVITIES AT AOC 40				\$ 10,081

O&M COSTS OCCURING OVER THIRTY YEARS				
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
				-
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
				-
MOWING - TRACTOR & OPERATOR	1	DAY	500.00	500
SUBTOTAL THIS PAGE				\$ 3,731

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
 LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE AOC 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04
 DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL O&M COSTS				
AOC 40 CAP IN PLACE				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER THIRTY YEARS - TOTAL FROM PREVIOUS PAGE				\$ 3,731
ENVIRONMENTAL MONITORING				
SEDIMENT SAMPLE COLLECTION 4 LOCATIONS, ONCE EVERY 5 YEARS	0.1739	LS	1200.00	209
SEDIMENT SAMPLE ANALYSIS, ONCE EVERY 5 YEARS, 4 SAMPLES PLUS 1 QA/QC, SVOCs AND INORGANICS ANNUALIZED	0.8695	SMPL	715.00	622
GROUNDWATER SAMPLE COLLECTION 7 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	2700.00	5,400
GROUNDWATER SAMPLE ANALYSIS 7 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	18	SMPL	900.00	16,200
FIVE YEAR EDUCATIONAL PROGRAM PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 30,122

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 2: NO FURTHER ACTION AT SA 6, 12, 13, AND AOC 41;
LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE AOC 9, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL CAP IN PLACE O&M COSTS				
SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

ANNUAL O&M COSTS - FOR 30 YEARS				
TOTAL AOC 9				\$ 27,323
TOTAL AOC 40				30,122

UNDEVELOPED DESIGN DETAILS ~25%	14,555
TOTAL ANNUAL O&M COSTS - 30 YEARS	\$ 72,000

ANNUAL O&M COSTS - FOR 5 YEARS	
TOTAL AOC 40	\$ 10,081
UNDEVELOPED DESIGN DETAILS ~25%	2,919
TOTAL ANNUAL O&M COSTS - 5 YEARS	\$ 13,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

DIRECT COSTS				
NO FURTHER ACTION				
SA 6			\$	0
SA 12				0
SA 13				0
AOC 41				0
CAP IN PLACE				
AOC 9				3,301,000
AOC 11				1,269,000
AOC 40				1,758,000
TOTAL DIRECT COSTS				\$ 6,328,000

INDIRECT COSTS				
HEALTH AND SAFETY			5.00% \$	316,000
LEGAL, ADMIN, PERMITTING			5.00%	316,000
ENGINEERING			10.00%	633,000
SERVICES DURING CONSTRUCTION			10.00%	633,000
TOTAL INDIRECT COSTS				\$ 1,898,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 8,226,000

OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR AOC 9, 11, 40 - 30 YEARS				\$ 99,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				13,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 1,281,000

TOTAL COSTS				\$ 9,507,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
NO FURTHER ACTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SA 6				\$ 0
SA 12				0
SA 13				0
AOC 41				0

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 9				
SITE PREPARATION, DEBRIS EXCAVATION, & CAP CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 500 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	\$ 1,760
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT - ROLLER & OPERATOR	0.5	DAY	1570.00	785
GEOFABRIC	1100	SY	1.00	1,100
CLEAR TREES FROM SITE	3	AC	6900.00	20,700
EROSION CONTROL	700	LF	5.00	3,500
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	10	DAY	1760.00	17,600
LABORER	80	HR	33.50	2,680
TOTAL SITE PREPARATION				\$ 52,125
EXCAVATE DEBRIS AREA I, II, III, & IV & PLACE IN AREA V				
BACKHOE & OPERATOR	30	DAY	1460.00	\$ 43,800
LABORER	240	HR	33.50	8,040
DUMP TRUCK & DRIVER - 3 EA	90	DAY	770.00	69,300
DOZER & OPERATOR	30	DAY	1760.00	52,800
LABORER	240	HR	33.50	8,040
TOTAL EXCAVATE DEBRIS				\$ 181,980
CAP CONSTRUCTION				
SUBGRADE SOIL	50800	CY	10.00	\$ 508,000
TEXTURED GEOMEMBRANE	371000	SF	0.80	296,800
DRAINAGE SOIL	18200	CY	17.00	309,400
GEOTEXTILE FABRIC	371000	SF	0.10	37,100
MOISTURE RETENTION SOIL	28200	CY	10.00	282,000
VEGETATIVE SOIL	9500	CY	14.00	133,000
SPREAD & COMPACT - ROLLER & OPERATOR	132	DAY	1570.00	207,240
TOTAL CAP CONSTRUCTION				\$ 1,773,540
NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
CAP-IN-PLACE AOCs 9, 11, 40
LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 9				
SITE RESTORATION, MONITORING WELLS, & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE RESTORATION				
DEBRIS AREA I - IV FILL MATERIAL	25250	CY	10.00	\$ 252,500
DEBRIS AREA I - IV VEGETATIVE SOIL	2700	CY	14.00	37,800
CHAIN LINK FENCE	2500	LF	13.00	32,500
12' SWING GATE	2	EA	800.00	1,600
FERTILIZE, SEED, MULCH	62000	SY	0.50	31,000
SPREAD & COMPACT - ROLLER & OPERATOR	35	DAY	1570.00	54,950
TOTAL SITE RESTORATION				\$ 410,350
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 9 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 194,600
TOTAL SITE PREPARATION				52,125
TOTAL DEBRIS EXCAVATION				181,980
TOTAL CAP CONSTRUCTION				1,773,540
TOTAL SITE RESTORATION				410,350
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				660,405
TOTAL AOC 9				\$ 3,301,000

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 11				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 850 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	2	DAY	1760.00	\$ 3,520
GRAVEL - 12" THICK	650	CY	10.00	6,500
SPREAD & COMPACT	1	DAY	1570.00	1,570
GEOFABRIC	1900	SY	2.00	3,800
CLEAR TREES FROM SITE	0.5	AC	4300.00	2,150
EROSION CONTROL	900	LF	5.00	4,500
				-
				-
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	3	DAY	1760.00	5,280
LABORER	24	HR	33.50	804
				-
TOTAL SITE PREPARATION				\$ 28,124
				-
CAP CONSTRUCTION				
SUBGRADE SOIL	23550	CY	10.00	\$ 235,500
TEXTURED GEOMEMBRANE	115650	SF	0.80	92,520
DRAINAGE SOIL	5900	CY	17.00	100,300
GEOTEXTILE FABRIC	115650	SF	0.10	11,565
MOISTURE RETENTION SOIL	9220	CY	10.00	92,200
RIPRAP	7450	CY	30.00	223,500
SPREAD & COMPACT	45	DAY	1570.00	70,650
				-
TOTAL CAP CONSTRUCTION				\$ 826,235
NOTE: ALL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
				-
				-
SITE RESTORATION				
CHAIN LINK FENCE	1600	LF	13.00	\$ 20,800
12' SWING GATE	1	EA	800.00	800
				-
TOTAL SITE RESTORATION				\$ 21,600
				-
				-
				-

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
CAP-IN-PLACE AOCs 9, 11, 40
LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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CAP IN PLACE AOC 11
MONITORING WELLS & INSTITUTIONAL CONTROLS
DESCRIPTION          QTY    UNIT    UNIT    TOTAL
                     -----
MONITORING WELLS - 4" DIA x 30' DEEP          4    EA    4500.00  $    18,000

INSTITUTIONAL CONTROLS          1    LS    10000.00  $    10,000
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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 11 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 111,510
TOTAL SITE PREPARATION				28,124
TOTAL CAP CONSTRUCTION				826,235
TOTAL SITE RESTORATION				21,600
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				253,531
TOTAL AOC 11				\$ 1,269,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40 SITE PREPARATION AND MOBILIZATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD SEDIMENT AREA 1				
CLEAR & GRUB LIGHT VEGETATION	0.1	AC	4300.00	\$ 430
GRADE- DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 12" THICK	360	CY	10.00	3,600
FILTER FABRIC	550	SY	1.00	550
SPREAD & COMPACT	0.5	DAY	1570.00	785
ACCESS ROAD SEDIMENT AREA 2				
CLEAR & GRUB LIGHT VEGETATION	0.1	AC	4300.00	430
GRADE- DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 24" THICK	340	CY	10.00	3,400
SPREAD & COMPACT	0.5	DAY	1570.00	785
FILTER FABRIC	550	SY	1.00	550
ACCESS ROAD FOR CAPPING - 500 LF				-
CLEAR & GRUB LIGHT VEGETATION	0.35	AC	4300.00	1,505
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 24" THICK	1450	CY	10.00	14,500
FILTER FABRIC	2000	SY	1.00	2,000
SPREAD & COMPACT	2	DAY	1570.00	3,140
PARKING AREA				
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
SEDIMENT DEWATERING PAD				-
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
LINER	10000	SF	0.60	6,000
SUMP & SUMP PUMP	1	LS	2500.00	2,500
DECON AREA - 10'x20'	3	EA	1000.00	3,000
				-
				-
				-
				-
				-
				-
CAP MATERIALS STOCKPILE AREA				-
CLEAR & GRUB LIGHT VEGETATION	1	AC	4300.00	4,300
GRADE- DOZER & OPERATOR	2	DAY	1760.00	3,520
TOTAL THIS PAGE				\$ 61,450

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40				
SITE PREPARATION AND MOBILIZATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				\$ 61,450
MOBILIZATION				
EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	820
DUMP TRUCK	6	EA	385.00	2,310
BACKHOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
CRANE & CLAMSHELL BUCKET	2	EA	640.00	1,280
ROLLER	2	EA	785.00	1,570
FRAC TANK	4	EA	250.00	1,000
DEWATERING PUMP & HOSE	2	EA	100.00	200
OFFICE TRAILER	4	MON	150.00	600
STORAGE TRAILER	4	MON	150.00	600
TRAILER DELIVERY, SET-UP, REMOVAL	2	EA	300.00	600
TOILET - 2 EA	36	WK	25.00	900
WATER COOLER - 2 EA	36	WK	25.00	900
WATER	180	DAY	15.00	2,700
TELEPHONE SERVICE	4	MON	500.00	2,000
ELECTRICITY	4	MON	250.00	1,000
PICK-UP (2 EA)	8	MON	1000.00	8,000
OFFICE EQUIPMENT	4	MON	1000.00	4,000
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
LABORER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	33.50	5,360
CARPENTER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	48.00	7,680
ELECTRICIAN (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	50.50	8,080
SITE SUPERINTENDANT (4 MON*210HR/MON)	840	MNHR	65.00	54,600
FOREMAN (4 MON*210HR/MON)	840	MNHR	55.00	46,200
CLERK/TYPIST (4 MON*168HR/MON)	672	MNHR	25.00	16,800
TOTAL SITE PREPARATION AND MOBILIZATION				\$ 234,370

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40 SEDIMENT REMOVAL AND DISPOSAL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CONSTRUCT SILT BARRIER AROUND CONTAMINATED AREAS	400	LF	25.00	\$ 10,000
EXCAVATE WITH CLAMSHELL 1200 CY SEDIMENTS + 1600 CY ACCESS ROADS/WORK PLATFORMS	28	DAY	1280.00	35,840
HAUL SEDIMENTS TO DEWATERING PAD (2 EA DUMP TRUCK & DRIVER)	56	DAY	770.00	43,120
LOAD DRY SEDIMENTS FOR TRANSPORTATION TO DISPOSAL AREA (FRONT END LOADER & OPERATOR)	14	DAY	825.00	11,550
LABORERS - 2 EA FOR 35 DAYS	560	MNHR	33.50	18,760
TCLP TESTING	2	SMPL	1400.00	2,800
ON-SITE STABILIZATION OF SEDIMENTS WITH SAND	600	CY	15.00	9,000
TRANSPORTATION & DISPOSAL AT AOC 9 (3 EA DUMP TRUCK & DRIVER)	42	DAY	770.00	32,340
TREATMENT OF WATER	1	LS	21800.00	21,800
PUMP WATER FROM DEWATERING PAD TO POND	28	DAY	50.00	1,400
TOTAL SEDIMENT REMOVAL AND DISPOSAL				\$ 186,610

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40				
WETLAND RESTORATION, MONITORING WELLS, DRUM REMOVAL AND DISPOSAL	QTY	UNIT	UNIT COST	TOTAL
DESCRIPTION				
WETLAND RESTORATION	1.5	AC	50000.00	\$ 75,000
MONITORING WELLS - 4" DIA x 30' DEEP	2	EA	4500.00	\$ 9,000
DRUM REMOVAL AND DISPOSAL				
BACKHOE & OPERATOR	3	DAY	1460.00	\$ 4,380
LABORER - 2 EA, 3 DAYS	48	MNHR	33.50	1,608
TRANSPORT DRUMS TO AOC 9	3	DAY	770.00	2,310
DUMP TRUCK & DRIVER				
TCLP TESTING OF DRUM CONTENTS	2	EA	1400.00	2,800
TOTAL DRUM REMOVAL AND DISPOSAL				\$ 11,098

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 40				
CAP CONSTRUCTION, INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CAP CONSTRUCTION				
SILT FENCE ALONG TOE OF LANDFILL	1500	LF	5.00	\$ 7,500
CLEAR & GRUB SITE	4.4	AC	6900.00	30,360
LONG STICK EXCAVATOR	5	DAY	1750.00	8,750
GRADE SITE - DOZER & OPERATOR	5	DAY	1760.00	8,800
CUT LANDFILL WASTE WITH DOZER	7	DAY	1760.00	12,320
IMPORTED FILL	2500	CY	10.00	25,000
SPREAD & COMPACT WASTE & FILL	14	DAY	1570.00	21,980
SUBGRADE FILL	7100	CY	10.00	71,000
SPREAD & COMPACT SUBGRADE FILL	9	DAY	1570.00	14,130
TEXTURED GEOMEMBRANE	192000	SF	0.80	153,600
10-3 SAND DRAINAGE LAYER	9250	CY	17.00	157,250
SPREAD & COMPACT DRAINAGE LAYER	13	DAY	1570.00	20,410
GEOTEXTILE FILTER FABRIC	192000	SF	0.10	19,200
MOISTURE RETENTION LAYER	13900	CY	10.00	139,000
SPREAD & COMPACT MOISTURE RETENTION LAYER	18	DAY	1570.00	28,260
VEGETATIVE MATERIAL	4600	CY	14.00	64,400
SPREAD & COMPACT VEGETATIVE LAYER	6	DAY	1570.00	9,420
SEED, FERTILIZE, MULCH	4.4	AC	2000.00	8,800
RIPRAP	2250	CY	30.00	67,500
GUARD RAIL ALONG ROAD	1000	LF	12.50	12,500
TOTAL CAP CONSTRUCTION				\$ 880,180
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION AND MOBILIZATION				\$ 234,370
TOTAL SEDIMENT REMOVAL & DISPOSAL				186,610
TOTAL WETLAND RESTORATION				75,000
TOTAL MONITORING WELLS				9,000
TOTAL DRUM REMOVAL & DISPOSAL				11,098
TOTAL CAP CONSTRUCTION				880,180
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				351,742
TOTAL SA 13				\$ 1,758,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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ANNUAL O&M COSTS				
CAP IN PLACE AOC 9				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
FRONT END LOADER & OPER	2	DAY	825.00	1,650
LABORER - 2 EA	32	MNHR	33.50	1,072
MATERIALS	1	LS	1000.00	1,000
INSPECTION - 1 DAY @ 2 MEN/DAY	16	MNHR	75.00	1,200
MOWING - TRACTOR & OPERATOR	5	DAY	500.00	2,500
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 27,323

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

ANNUAL O&M COSTS CAP IN PLACE AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC	12	SMPL	900.00	10,800
EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS			\$	21,592

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS CAP IN PLACE AOC 40				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURING OVER FIVE YEARS				
WETLANDS RESTORATION MONITORING (5 YEARS)				
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	\$ 2,400
BIOMONITORING, BIENNIALY				-
FOR 5 YEARS	0.4831	LS	15000.00	7,246
				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	2500.00	435
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				\$ 10,081

O&M COSTS OCCURING OVER THIRTY YEARS				
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
				-
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
				-
MOWING - TRACTOR & OPERATOR	1	DAY	500.00	500
SUBTOTAL THIS PAGE				\$ 3,731

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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ANNUAL O&M COSTS				
CAP IN PLACE AOC 40				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURING OVER THIRTY YEARS - TOTAL FROM PREVIOUS PAGE				\$ 3,731
ENVIRONMENTAL MONITORING				
SEDIMENT SAMPLE COLLECTION 4 LOCATIONS, ONCE EVERY 5 YEARS	0.1739	LS	1200.00	209
SEDIMENT SAMPLE ANALYSIS, ONCE EVERY 5 YEARS, 4 SAMPLES PLUS 1 QA/QC, SVOCs AND INORGANICS ANNUALIZED	0.8695	SMPL	715.00	622
GROUNDWATER SAMPLE COLLECTION 7 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	2700.00	5,400
GROUNDWATER SAMPLE ANALYSIS 7 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	18	SMPL	900.00	16,200
FIVE YEAR EDUCATIONAL PROGRAM PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 30,122

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 3: NO FURTHER ACTION SAs 6, 12, 13, AOC 41;
 CAP-IN-PLACE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
ANNUAL O&M COSTS				
CAP IN PLACE SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

ANNUAL O&M COSTS - FOR 30 YEARS				
TOTAL AOC 9				\$ 27,323
TOTAL AOC 11				21,592
TOTAL AOC 40				30,122

UNDEVELOPED DESIGN DETAILS ~25%	19,963
TOTAL ANNUAL O&M COSTS - 30 YEARS	\$ 99,000

ANNUAL O&M COSTS - FOR 5 YEARS	
TOTAL AOC 40	\$ 10,081
UNDEVELOPED DESIGN DETAILS ~25%	2,919
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS	\$ 13,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
NO FURTHER ACTION				
SA 6			\$	0
SA 12				0
SA 13				0
AOC 41				0
LIMITED REMOVAL AT AOC 11				44,000
EXCAVATE AND CONSOLIDATE				
AOC 9				3,835,000
AOC 40				3,370,000
CONSOLIDATION LANDFILL CONSTRUCTION				5,240,000
TOTAL DIRECT COSTS				\$ 12,489,000
INDIRECT COSTS				
HEALTH AND SAFETY			5.00%	\$ 624,000
LEGAL, ADMIN, PERMITTING			5.00%	624,000
ENGINEERING			10.00%	1,249,000
SERVICES DURING CONSTRUCTION			10.00%	1,249,000
TOTAL INDIRECT COSTS				\$ 3,746,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 16,235,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YRS			\$	4,000
TOTAL ANNUAL O&M COSTS FOR NEW LANDFILL - 30 YRS				23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS				29,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS			\$	411,000
TOTAL COSTS				\$ 16,646,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====

NO FURTHER ACTION

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SA 6				\$ 0
SA 12				0
SA 13				0
AOC 41				0

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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LIMITED REMOVAL AT AOC 11, PLACE IN CONSOLIDATION LANDFILL

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 22,945
BACKFILL				
PURCHASED FROM OFF-SITE	625	CY	10.00	6,250
(INCLUDING 30% SWELL FACTOR)				-
				-
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	2	DAY	1570.00	3,140
FERTILIZE, SEED, MULCH	5000	SY	0.50	2,500
				-
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				9,165
TOTAL AOC 11				\$ 44,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 9

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	32	EA	385.00	\$ 12,320
BACKHOE	4	EA	730.00	2,920
ROLLER	8	EA	785.00	6,280
OFFICE TRAILER	5	MON	150.00	750
STORAGE TRAILER	5	MON	100.00	500
SET UP TRAILER	2	EA	500.00	1,000
TOILET - 2 EA	44	WK	25.00	1,100
WATER COOLER - 2 EA	44	WK	25.00	1,100
WATER	220	DAY	15.00	3,300
TELEPHONE SERVICE	5	MON	500.00	2,500
ELECTRICITY	5	MON	250.00	1,250
PICK-UP (2 EA)	10	MON	1000.00	10,000
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
SITE SUPERINTENDANT (5 MON * 210 HR/MON)	1050	MNHR	65.00	68,250
FOREMEN (5 MON * 210 HR/MON)	1050	MNHR	55.00	57,750
CLERK/TYPIST (5 MON * 168 HR/MON)	840	MNHR	25.00	21,000
CLEAR TREES	2.5	AC	6900.00	17,250
EROSION CONTROL	700	LF	5.00	3,500
UXO CLEARANCE	70	DAY	1800.00	126,000
EXCAVATION OF 112000 CY OF DEBRIS				
BACKHOE & OPERATOR (2 EA)	140	DAY	1460.00	204,400
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & OPERATOR (16 EA)	1120	DAY	770.00	862,400
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				
ROLLER & OPERATOR (4 EA)	280	DAY	1570.00	439,600
TOTAL THIS PAGE				\$ 1,845,670

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
EXCAVATE AND CONSOLIDATE AOC 9				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 1,845,670
BACKFILL (112,000 * 1.3 = 145,600 CY REQUIRED)				
AVAILABLE FROM CONSOLIDATION	88750	CY	0.00	0
LANDFILL EXCAVATION				
LOAD STOCKPILED BACKFILL	110	DAY	825.00	90,750
HAUL & DUMP	330	DAY	770.00	254,100
PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	56850	CY	10.00	568,500
SITE RESTORATION				
BACKFILL, GRADE, COMPACT (2 EA)	182	DAY	1570.00	285,740
FERTILIZE, SEED, MULCH	36300	SY	0.50	18,150
WETLAND RESTORATION	0.1	AC	50000.00	5,000
UNDEVELOPED DESIGN DETAILS ~25%				767,090
TOTAL AOC 9				\$ 3,835,000

ESTIMATOR: P. R. MARTIN

EXCAVATE AND CONSOLIDATE AOC 40

[illegible]

ESTIMATOR: P. R. MARTIN

[illegible]

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 40				
SEDIMENT REMOVAL AND DISPOSAL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CONSTRUCT SILT FENCE AROUND CONTAMINATED AREAS	650	LF	5.00	\$ 3,250
EXCAVATE WITH CLAMSHELL 1200 CY SEDIMENTS + 600 CY ACCESS ROADS/WORK PLATFORMS	19	DAY	1280.00	24,320
HAUL SEDIMENTS TO DEWATERING PAD (2 EA DUMP TRUCK & DRIVER)	38	DAY	770.00	29,260
LOAD DRY SEDIMENTS FOR TRANSPORTATION TO DISPOSAL AREA (FRONT END LOADER & OPERATOR)	10	DAY	825.00	8,250
LABORERS - 2 EA FOR 25 DAYS	400	MNHR	33.50	13,400
TCLP TESTING	2	SMPL	1500.00	3,000
ON-SITE STABILIZATION OF SEDIMENTS WITH SAND	400	CY	15.00	6,000
TRANSPORTATION AND DISPOSAL AT CONSOLIDATION LANDFILL (3 EA DUMP TRUCK & DRIVER)	30	DAY	770.00	23,100
TRANSPORTATION OF WATER	140000	GAL	INCL WITH DISPOSAL	
TREATMENT OF DEWATERING WATER	1	LS	21800.00	21,800
PUMP WATER FROM DEWATERING PAD TO PONDS	12	DAY	50.00	600
TOTAL SEDIMENT REMOVAL AND DISPOSAL				\$ 132,980

ESTIMATOR: P. R. MARTIN

[illegible]

ESTIMATOR: P. R. MARTIN

EXCAVATE AND CONSOLIDATE AOC 40				
EXCAVATION AND BACKFILL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CLEAR & GRUB SITE	4	AC	4300.00	\$ 17,200
EROSION CONTROL	500	LF	5.00	2,500
SUMP PUMP & HOSES	6	MON	2500.00	15,000
UXO CLEARANCE	138	DAY	1800.00	248,400
EXCAVATION OF 110000 CY OF DEBRIS BACKHOE & OPERATOR	138	DAY	1460.00	201,480
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED) DUMP TRUCK & DRIVER (8 EA)	1100	DAY	770.00	847,000
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT ROLLER & OPERATOR (2 EA)	276	DAY	1570.00	433,320
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	18710	CY	10.00	187,100
SITE RESTORATION BACKFILL, GRADE, COMPACT FERTILIZE, SEED, MULCH	24 19360	DAY SY	1570.00 0.50	37,680 9,680
WETLANDS RESTORATION	4	AC	50000.00	200,000
MONITORING WELLS, 4" DIA x 30' DP	2	EA	2400.00	4,800
GUIDE RAIL ALONG ROAD	1000	LF	12.50	12,500
				-
				-
				-
				-
				-
				-
				-
				-
TOTAL EXCAVATION AND BACKFILL				\$ 2,216,660

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 40

=====

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
<hr/>				
TOTAL SITE PREPARATION			\$	52,568
				-
TOTAL MOBILIZATION				282,810
				-
TOTAL SEDIMENT REMOVAL AND DISPOSAL				132,980
				-
TOTAL DRUM REMOVAL AND DISPOSAL				11,298
				-
TOTAL EXCAVATION AND BACKFILL				2,216,660
				-
UNDEVELOPED DESIGN DETAILS ~25%				673,685
				<hr/>
TOTAL AOC 40			\$	3,370,000

ESTIMATOR: P. R. MARTIN

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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CONSOLIDATION LANDFILL CONSTRUCTION				
LINER CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

EXCAVATE LANDFILL BASE & BY-PASS DITCH				
BACK HOE & OPERATOR (2 EA)	126	DAY	1460.00	\$ 183,960
HAUL TO ON-SITE STOCKPILE (23250 CY)				
DUMP TRUCK & DRIVER (3 EA)	45	DAY	770.00	34,650
HAUL TO AOC-9 & STOCKPILE (88750 CY)				
DUMP TRUCK & DRIVER (16 EA)	880	DAY	770.00	677,600
DOZER & OPERATOR	55	DAY	1760.00	96,800
				-
CLAY	31850	CY	10.00	318,500
GEOMEMBRANE	330000	SF	0.65	214,500
FILTER FABRIC	330000	SF	0.10	33,000
10-2 SAND DRAINAGE LAYER	15925	CY	12.00	191,100
10-3 SAND DRAINAGE LAYER	15925	CY	17.00	270,725
ROLLER & OPERATOR	80	DAY	1570.00	125,600
				-
				-
DRAINAGE PIPING				
6" DIA PERF PVC PIPE	2500	LF	6.00	15,000
12" DIA SOLID WALL PVC PIPE	1600	LF	15.00	24,000
6"x12" PVC WYE	5	EA	500.00	2,500
				-
LEACHATE PUMPING CHAMBER				
5' DIA PRECAST MANHOLE	10	VLF	250.00	2,500
FRAME, COVER, ETC.	1	LS	300.00	300
CONCRETE FILL PAD, SUMP, ELECTRICAL	1	LS	35000.00	35,000
CONTROLS, ALARM, FILL PIPING, BOLLARDS				-
HAUL LEACHATE TO BASE TREATMENT PLANT	2600	HR	100.00	260,000
10 HR/DAY * 5 DAY/WK * 52 WK				-
				-
				-
NOTE: ALL LINER SOIL MATERIAL QUANTITIES				-
INCLUDE A 30% SWELL FACTOR				-
				-
TOTAL LINER CONSTRUCTION				\$ 2,485,735

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
LIMITED REMOVAL AT AOC 11;
EXCAVATE AND CONSOLIDATE AOCs 9, 40
LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

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ESTIMATOR: P. R. MARTIN

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CONSOLIDATION LANDFILL CONSTRUCTION

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOBILIZATION				\$ 357,910
TOTAL SITE PREPARATION				115,500
TOTAL LINER CONSTRUCTION				2,485,735
TOTAL FINAL COVER CONSTRUCTION				1,232,875

UNDEVELOPED DESIGN DETAILS ~25%

1,047,980

TOTAL CONSOLIDATION LANDFILL CONSTRUCTION

\$ 5,240,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
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 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS				
AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS TWICE PER YEAR FOR TWO YEARS FOR SITE RESTORATION				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
MATERIALS	1	LS	500.00	500
LABORER - 2 EA	32	MNHR	33.50	1,072

UNDEVELOPED DESIGN DETAILS ~25%

888

TOTAL ANNUAL O&M COSTS

\$ 4,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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ANNUAL O&M COSTS AT CONSOLIDATION LANDFILL

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER THIRTY YEARS FOR CONSOLIDATION LANDFILL				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	10000.00	\$ 1,810
ENVIRONMENTAL MONITORING				-
GROUNDWATER, 4 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	8	SMPL	940.00	7,520
LANDFILL COVER MAINTENANCE				-
INSPECTION - 2 DAY @ 2 MEN/DAY	32	MNHR	75.00	2,400
GENERAL REPAIR				-
DUMP TRUCK & DRIVER	1	DAY	770.00	770
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
MOWING	2	EVENT	1000.00	2,000
BI-ANNUAL REPORT TO DEP - ANNUALIZED	0.4878	LS	2500.00	1,220
AYER WWTP USER FEE	600	CCF	2.00	1,200
UNDEVELOPED DESIGN DETAILS ~25%				4,220
TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 23,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
 LIMITED REMOVAL AT AOC 11;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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ANNUAL O&M COSTS AT AOC 40

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER FIVE YEARS FOR CSB LANDFILL				
SEDIMENT, 2 SAMPLES AT 2 LOCATIONS, ONE TIME ONLY AT YEAR 5				
METALS - ANNUALIZED	0.7239	SMPL	625.00	\$ 452
				-
GROUNDWATER MONITORING, 2 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	4	SMPL	1020.00	4,080
				-
SAMPLE COLLECTION (INCLUDES WELL	2	LS	2500	5,000
PURGE, SAMPLE COLLECTION, AND SHIPMENT)				-
				-
WETLANDS RESTORATION MONITORING				-
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	2,400
				-
BIO MONITORING, BI-ANNUALLY	0.4878	LS	15000.00	7,317
				-
FIVE YEAR EDUCATION PROGRAM ONCE	0.1810	LS	2500.00	452
PUBLIC MEETING - ANNUALIZED				-
				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	20000.00	3,619
				-
UNDEVELOPED DESIGN DETAILS ~25%				5,679
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEAR				\$ 29,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
LIMITED REMOVAL AT AOC 11				\$ 44,000
CAP IN PLACE				
SA 6				159,000
SA 12				507,000
SA 13				395,000
AOC 41				175,000
EXCAVATE AND CONSOLIDATE				
AOC 9				3,835,000
AOC 40				3,370,000
CONSOLIDATION LANDFILL CONSTRUCTION				5,240,000
TOTAL DIRECT COSTS				\$ 13,725,000
INDIRECT COSTS				
HEALTH AND SAFETY			5.00%	\$ 686,000
LEGAL, ADMIN, PERMITTING			5.00%	686,000
ENGINEERING			10.00%	1,373,000
SERVICES DURING CONSTRUCTION			10.00%	1,373,000
TOTAL INDIRECT COSTS				\$ 4,118,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 17,843,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YRS				\$ 4,000
TOTAL ANNUAL O&M COSTS FOR CAP-IN-PLACE AREAS - 30 YRS				\$ 109,000
TOTAL ANNUAL O&M COSTS FOR NEW LANDFILL - 30 YRS				\$ 23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS				\$ 29,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 1,764,000
TOTAL COSTS				\$ 19,607,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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LIMITED REMOVAL AND DISPOSAL IN CONSOLIDATION LANDFILL AOC 11

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 22,945
BACKFILL				
PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	625	CY	10.00	6,250
				-
				-
SITE RESTORATION				
BACKFILL, GRADE, COMPACT	2	DAY	1570.00	3,140
FERTILIZE, SEED, MULCH	5000	SY	0.50	2,500
				-
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				9,165
TOTAL AOC 11				\$ 44,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 6 MOB/DEMOB DESCRIPTION					QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)								
FRONT END LOADER					2	EA	410.00	\$ 820
DUMP TRUCK					2	EA	385.00	770
BACK HOE					2	EA	730.00	1,460
DOZER					2	EA	880.00	1,760
ROLLER					2	EA	785.00	1,570
								-
								-
OFFICE TRAILER					1	MON	150.00	150
STORAGE TRAILER					1	MON	100.00	100
SET UP TRAILER					2	EA	500.00	1,000
								-
TOILET - 2 EA					8	WK	25.00	200
WATER COOLER - 2 EA					8	WK	25.00	200
WATER					40	DAY	15.00	600
TELEPHONE SERVICE					1	MON	500.00	500
ELECTRICITY					1	MON	250.00	250
PICK-UP (2 EA)					2	MON	1000.00	2,000
								-
PUMPS, TOOLS, MINOR EQUIPMENT					1	MON	500.00	500
								-
SITE SUPERINTENDANT (1 MON * 210 HR/MON)					210	MNHR	65.00	13,650
FOREMEN (1 MON * 210 HR/MON)					210	MNHR	55.00	11,550
CLERK/TYPIST (1 MON * 168 HR/MON)					168	MNHR	25.00	4,200
								-
								-
								-
								-
								-
TOTAL MOB/DEMOB								\$ 41,280

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 6 SITE PREPARATION & CAP CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 675 LF x 15' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	\$ 1,760
GRAVEL - 12" THICK	375	CY	10.00	3,750
SPREAD & COMPACT	0.5	DAY	1570.00	785
GEOFABRIC	1125	SY	1.00	1,125
CLEAR TREES FROM SITE	0.25	AC	6900.00	1,725
ARCHAEOLOGICAL SURVEY OF LANDFILL				-
PROJECT MANAGER	1	DAY	425.00	425
PRINCIPAL INVESTIGATOR	1	DAY	385.00	385
PROJECT ARCHAEOLOGIST	7	DAY	280.00	1,960
ASSISTANT ARCHAEOLOGIST	6	DAY	195.00	1,170
WORK PROCESSOR	1	DAY	185.00	185
ODCs	1	LS	100.00	100
MILAGE	1000	MILE	0.25	250
PER DIEM	5	DAY	60.00	300
UXO CLEARANCE	2	DAY	1800.00	3,600
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
				-
TOTAL SITE PREPARATION				\$ 19,548
CAP CONSTRUCTION				
SUBGRADE SOIL	520	CY	10.00	\$ 5,200
TEXTURED GEOMEMBRANE	6750	SF	0.80	5,400
DRAINAGE SOIL	365	CY	17.00	6,205
GEOTEXTILE FABRIC LAYER	6750	SF	0.10	675
MOISTURE RETENTION SOIL	650	CY	10.00	6,500
VEGETATIVE SOIL	230	CY	14.00	3,220
SPREAD & COMPACT	3	DAY	1570.00	4,710
TOTAL CAP CONSTRUCTION				\$ 31,910

NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 6				
SITE RESTORATION, MONITORING WELLS, INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE RESTORATION				
CHAIN LINK FENCE	400	LF	13.00	\$ 5,200
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	1000	SY	0.50	500
TOTAL SITE RESTORATION				\$ 6,500
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 6 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 41,280
TOTAL SITE PREPARATION				19,548
TOTAL CAP CONSTRUCTION				31,910
TOTAL SITE RESTORATION				6,500
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				31,762
TOTAL SA 6				\$ 159,000

ESTIMATOR: P. R. MARTIN

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 12				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 300 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	80	CY	10.00	800
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	700	SY	1.00	700
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	325	LF	5.00	1,625
				-
UXO CLEARANCE	15	DAY	1800.00	27,000
				-
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	2	DAY	1760.00	3,520
LABORER	16	HR	33.50	536
				-
TOTAL SITE PREPARATION				\$ 38,904
				-
CAP CONSTRUCTION				
SUBGRADE SOIL	9450	CY	10.00	\$ 94,500
TEXTURED GEOMEMBRANE	40950	SF	0.80	32,760
DRAINAGE SOIL	2050	CY	17.00	34,850
GEOTEXTILE FABRIC LAYER	40950	SF	0.10	4,095
MOISTURE RETENTION SOIL	3200	CY	10.00	32,000
VEGETATIVE SOIL	1150	CY	14.00	16,100
SPREAD & COMPACT	20	DAY	1570.00	31,400
				-
TOTAL CAP CONSTRUCTION				\$ 245,705
				-
NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
				-
				-
SITE RESTORATION				
CHAIN LINK FENCE	1000	LF	13.00	\$ 13,000
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
				-
TOTAL SITE RESTORATION				\$ 15,000
				-
				-

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 12 MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00 \$	18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00 \$	10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 12 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 77,910
TOTAL SITE PREPARATION				38,904
TOTAL CAP CONSTRUCTION				245,705
TOTAL SITE RESTORATION				15,000
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				101,482
TOTAL SA 12				\$ 507,000

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 13				
MOB/DEMOB DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	\$ 820
DUMP TRUCK	2	EA	385.00	770
BACK HOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
ROLLER	2	EA	785.00	1,570
				-
				-
OFFICE TRAILER	1.5	MON	150.00	225
STORAGE TRAILER	1.5	MON	100.00	150
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	12	WK	25.00	300
WATER COOLER - 2 EA	12	WK	25.00	300
WATER	60	DAY	15.00	900
TELEPHONE SERVICE	1.5	MON	500.00	750
ELECTRICITY	1.5	MON	250.00	375
PICK-UP (2 EA)	3	MON	1000.00	3,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1.5	MON	500.00	750
				-
SITE SUPERINTENDANT (1.5 MON * 210 HR/MON)	315	MNHR	65.00	20,475
FOREMEN (1.5 MON * 210 HR/MON)	315	MNHR	55.00	17,325
CLERK/TYPIST (1.5 MON * 168 HR/MON)	252	MNHR	25.00	6,300
				-
				-
				-
				-
				-
TOTAL MOB/DEMOB				\$ 58,230

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 13				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 200 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	450	SY	1.00	450
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	300	LF	5.00	1,500
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
TOTAL SITE PREPARATION				\$ 10,201
CAP CONSTRUCTION				
SUBGRADE SOIL	5600	CY	10.00	\$ 56,000
TEXTURED GEOMEMBRANE	42100	SF	0.80	33,680
DRAINAGE SOIL	2100	CY	17.00	35,700
GEOTEXTILE FABRIC	42100	SF	0.10	4,210
MOISTURE RETENTION SOIL	3350	CY	10.00	33,500
VEGETATIVE SOIL	1150	CY	14.00	16,100
SPREAD & COMPACT	16	DAY	1570.00	25,120
TOTAL CAP CONSTRUCTION				\$ 204,310
NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
SITE RESTORATION				
CHAIN LINK FENCE	900	LF	13.00	\$ 11,700
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	5300	SY	0.50	2,650
TOTAL SITE RESTORATION				\$ 15,150

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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CAP IN PLACE SA 13				
MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 13 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 58,230
TOTAL SITE PREPARATION				10,201
TOTAL CAP CONSTRUCTION				204,310
TOTAL SITE RESTORATION				15,150
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				79,110
TOTAL SA 13				\$ 395,000

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 41				
MOB/DEMOB DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	\$ 820
DUMP TRUCK	2	EA	385.00	770
BACK HOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
ROLLER	2	EA	785.00	1,570
				-
				-
OFFICE TRAILER	1	MON	150.00	150
STORAGE TRAILER	1	MON	100.00	100
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	8	WK	25.00	200
WATER COOLER - 2 EA	8	WK	25.00	200
WATER	40	DAY	15.00	600
TELEPHONE SERVICE	1	MON	500.00	500
ELECTRICITY	1	MON	250.00	250
PICK-UP (2 EA)	2	MON	1000.00	2,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	MON	500.00	500
				-
SITE SUPERINTENDANT (1 MON * 210 HR/MON)	210	MNHR	65.00	13,650
FOREMEN (1 MON * 210 HR/MON)	210	MNHR	55.00	11,550
CLERK/TYPIST (1 MON * 168 HR/MON)	168	MNHR	25.00	4,200
				-
				-
				-
				-
				-
TOTAL MOB/DEMOB				\$ 41,280

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 41				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 350 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	270	CY	10.00	2,700
GEOFABRIC	800	SY	1.00	800
SPREAD & COMPACT	0.5	DAY	1570.00	785
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	150	LF	5.00	750
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
UXO CLEARANCE	2	DAY	1800.00	3,600
TOTAL SITE PREPARATION				\$ 14,993
CAP CONSTRUCTION				
SUBGRADE SOIL	625	CY	10.00	\$ 6,250
TEXTURED GEOMEMBRANE	10400	SF	0.80	8,320
DRAINAGE SOIL	565	CY	17.00	9,605
GEOTEXTILE FABRIC LAYER	10400	SF	0.10	1,040
MOISTURE RETENTION SOIL	990	CY	10.00	9,900
VEGETATIVE SOIL	300	CY	14.00	4,200
SPREAD & COMPACT	5	DAY	1570.00	7,850
TOTAL CAP CONSTRUCTION				\$ 47,165
NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
SITE RESTORATION				
CHAIN LINK FENCE	550	LF	13.00	\$ 7,150
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	1600	SY	0.50	800
TOTAL SITE RESTORATION				\$ 8,750

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 41 MONITORING WELLS & INSTITUTIONAL CONTROLS						
DESCRIPTION	QTY	UNIT	UNIT COST		TOTAL	
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$	18,000	
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$	10,000	

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
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 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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CAP IN PLACE AOC 41
 SUMMARY SHEET
 DESCRIPTION

QTY UNIT UNIT COST TOTAL

TOTAL MOB/DEMOB				\$ 41,280
TOTAL SITE PREPARATION				14,993
TOTAL CAP CONSTRUCTION				47,165
TOTAL SITE RESTORATION				8,750
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				34,812
TOTAL SA 13				\$ 175,000

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 9

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	32	EA	385.00	\$ 12,320
BACKHOE	4	EA	730.00	2,920
ROLLER	8	EA	785.00	6,280
OFFICE TRAILER	5	MON	150.00	750
STORAGE TRAILER	5	MON	100.00	500
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	44	WK	25.00	1,100
WATER COOLER - 2 EA	44	WK	25.00	1,100
WATER	220	DAY	15.00	3,300
TELEPHONE SERVICE	5	MON	500.00	2,500
ELECTRICITY	5	MON	250.00	1,250
PICK-UP (2 EA)	10	MON	1000.00	10,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
				-
SITE SUPERINTENDANT (5 MON * 210 HR/MON)	1050	MNHR	65.00	68,250
FOREMEN (5 MON * 210 HR/MON)	1050	MNHR	55.00	57,750
CLERK/TYPIST (5 MON * 168 HR/MON)	840	MNHR	25.00	21,000
				-
CLEAR TREES	2.5	AC	6900.00	17,250
				-
EROSION CONTROL	700	LF	5.00	3,500
				-
UXO CLEARANCE	70	DAY	1800.00	126,000
				-
				-
				-
EXCAVATION OF 112000 CY OF DEBRIS				-
BACKHOE & OPERATOR (2 EA)	140	DAY	1460.00	204,400
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & OPERATOR (16 EA)	1120	DAY	770.00	862,400
				-
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (4 EA)	280	DAY	1570.00	439,600
				-
				-
				-
TOTAL THIS PAGE				\$ 1,845,670

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 9

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 1,845,670
BACKFILL (112,000 * 1.3 = 145,600 CY REQUIRED)				
AVAILABLE FROM CONSOLIDATION LANDFILL EXCAVATION	88750	CY	0.00	0
LOAD STOCKPILED BACKFILL	110	DAY	825.00	90,750
HAUL & DUMP	330	DAY	770.00	254,100
PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	56850	CY	10.00	568,500
SITE RESTORATION				
BACKFILL, GRADE, COMPACT (2 EA)	182	DAY	1570.00	285,740
FERTILIZE, SEED, MULCH	36300	SY	0.50	18,150
WETLAND RESTORATION	0.1	AC	50000.00	5,000
UNDEVELOPED DESIGN DETAILS ~25%				767,090
TOTAL AOC 9				\$ 3,835,000

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
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DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 40

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION				\$ 52,568
TOTAL MOBILIZATION				-
TOTAL SEDIMENT REMOVAL AND DISPOSAL				282,810
TOTAL DRUM REMOVAL AND DISPOSAL				-
TOTAL EXCAVATION AND BACKFILL				132,980
				-
				11,298
				-
				2,216,660
				-
UNDEVELOPED DESIGN DETAILS ~25%				673,685
TOTAL AOC 40				\$ 3,370,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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CONSOLIDATION LANDFILL CONSTRUCTION				
LINER CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

EXCAVATE LANDFILL BASE & BY-PASS DITCH				
BACK HOE & OPERATOR (2 EA)	126	DAY	1460.00	\$ 183,960
HAUL TO ON-SITE STOCKPILE (23250 CY)				
DUMP TRUCK & DRIVER (3 EA)	45	DAY	770.00	34,650
HAUL TO AOC-9 & STOCKPILE (88750 CY)				
DUMP TRUCK & DRIVER (16 EA)	880	DAY	770.00	677,600
DOZER & OPERATOR	55	DAY	1760.00	96,800
				-
				-
CLAY	31850	CY	10.00	318,500
GEOMEMBRANE	330000	SF	0.65	214,500
FILTER FABRIC	330000	SF	0.10	33,000
10-2 SAND DRAINAGE LAYER	15925	CY	12.00	191,100
10-3 SAND DRAINAGE LAYER	15925	CY	17.00	270,725
ROLLER & OPERATOR	80	DAY	1570.00	125,600
				-
				-
DRAINAGE PIPING				-
6" DIA PERF PVC PIPE	2500	LF	6.00	15,000
12" DIA SOLID WALL PVC PIPE	1600	LF	15.00	24,000
6"x12" PVC WYE	5	EA	500.00	2,500
				-
LEACHATE PUMPING CHAMBER				-
5' DIA PRECAST MANHOLE	10	VLF	250.00	2,500
FRAME, COVER, ETC.	1	LS	300.00	300
CONCRETE FILL PAD, SUMP, ELECTRICAL	1	LS	35000.00	35,000
CONTROLS, ALARM, FILL PIPING, BOLLARDS				-
HAUL LEACHATE TO BASE TREATMENT PLANT	2600	HR	100.00	260,000
10 HR/DAY * 5 DAY/WK * 52 WK				-
				-
				-
				-
NOTE: ALL LINER SOIL MATERIAL QUANTITIES				-
INCLUDE A 30% SWELL FACTOR				-
				-
				-
TOTAL LINER CONSTRUCTION				\$ 2,485,735

ESTIMATOR: P. R. MARTIN

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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CONSOLIDATION LANDFILL CONSTRUCTION

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOBILIZATION				\$ 357,910
TOTAL SITE PREPARATION				115,500
TOTAL LINER CONSTRUCTION				2,485,735
TOTAL FINAL COVER CONSTRUCTION				1,232,875

UNDEVELOPED DESIGN DETAILS ~25%

1,047,980

TOTAL CONSOLIDATION LANDFILL CONSTRUCTION

\$ 5,240,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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ANNUAL O&M COSTS				
AOC 11 LIMITED REMOVAL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS TWICE PER YEAR FOR TWO YEARS FOR SITE RESTORATION				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
MATERIALS	1	LS	500.00	500
LABORER - 2 EA	32	MNHR	33.50	1,072

UNDEVELOPED DESIGN DETAILS ~25%

888

TOTAL ANNUAL O&M COSTS

\$ 4,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL O&M COSTS				
CAP IN PLACE SA 6				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE,				-
SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC	12	SMPL	900.00	10,800
EQUIVALENT SEMI-ANNUALLY, SVOCs,				
INORGANICS, WATER QUALITY PARAMETERS				
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO	0.4831	LS	1000.00	483
MADEP - ANNUALIZED				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608

TOTAL ANNUAL O&M COSTS				\$21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS CAP IN PLACE SA 12				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS	12	SMPL	900.00	10,800
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				-
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				-
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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ANNUAL O&M COSTS				
CAP IN PLACE SA 13				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
				-
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
				-
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE,				-
SAMPLE COLLECTION, AND SHIPPING)				-
				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC	12	SMPL	900.00	10,800
EQUIVALENT SEMI-ANNUALLY, SVOCs,				
INORGANICS, WATER QUALITY PARAMETERS				
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO	0.4831	LS	1000.00	483
MADEP - ANNUALIZED				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS CAP IN PLACE AOC 41				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS	12	SMPL	900.00	10,800
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				-
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				-
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS			\$	21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CAP IN PLACE ANNUAL O&M COSTS SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
ANNUAL O&M COSTS - FOR 30 YEARS				
TOTAL SA 6				\$ 21,842
TOTAL SA 12				21,842
TOTAL SA 13				21,842
TOTAL AOC 41				21,842
UNDEVELOPED DESIGN DETAILS ~25%				21,632
TOTAL ANNUAL O&M COSTS - 30 YEARS				\$ 109,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS AOC 40				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER FIVE YEARS FOR CSB LANDFILL				
SEDIMENT, 2 SAMPLES AT 2 LOCATIONS, ONE TIME ONLY AT YEAR 5				
METALS - ANNUALIZED	0.7239	SMPL	625.00	\$ 452
GROUNDWATER MONITORING, 2 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	4	SMPL	1020.00	4,080
SAMPLE COLLECTION (INCLUDES WELL	2	LS	2500	5,000
PURGE, SAMPLE COLLECTION, AND SHIPMENT)				-
WETLANDS RESTORATION MONITORING				-
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	2,400
BIO MONITORING, BI-ANNUALLY	0.4878	LS	15000.00	7,317
FIVE YEAR EDUCATION PROGRAM ONCE	0.1810	LS	2500.00	452
PUBLIC MEETING - ANNUALIZED				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	20000.00	3,619
UNDEVELOPED DESIGN DETAILS ~25%				5,679
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				\$ 29,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
 CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS CONSOLIDATION LANDFILL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURING OVER THIRTY YEARS FOR CONSOLIDATION LANDFILL				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	10000.00	\$ 1,810
ENVIRONMENTAL MONITORING				-
GROUNDWATER, 4 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	8	SMPL	940.00	7,520
LANDFILL COVER MAINTENANCE				-
INSPECTION - 2 DAY @ 2 MEN/DAY	32	MNHR	75.00	2,400
GENERAL REPAIR				-
DUMP TRUCK & DRIVER	1	DAY	770.00	770
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
MOWING	2	EVENT	1000.00	2,000
BI-ANNUAL REPORT TO DEP - ANNUALIZED	0.4878	LS	2500.00	1,220
AYER WWTP USER FEE	600	CCF	2.00	1,200
UNDEVELOPED DESIGN DETAILS ~25%				4,220
TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 23,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
CAP IN PLACE				
SA 6				\$ 159,000
SA 12				507,000
SA 13				395,000
AOC 41				175,000
EXCAVATE AND CONSOLIDATE				
AOC 9				3,835,000
AOC 11				1,571,000
AOC 40				3,370,000
CONSOLIDATION LANDFILL CONSTRUCTION				
				5,240,000
TOTAL DIRECT COSTS				\$ 15,252,000
INDIRECT COSTS				
HEALTH AND SAFETY			5.00%	\$ 763,000
LEGAL, ADMIN, PERMITTING			5.00%	763,000
ENGINEERING			10.00%	1,525,000
SERVICES DURING CONSTRUCTION			10.00%	1,525,000
TOTAL INDIRECT COSTS				\$ 4,576,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 19,828,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR CAP-IN-PLACE AREAS - 30 YRS				\$ 109,000
TOTAL ANNUAL O&M COSTS FOR NEW LANDFILL - 30 YRS				23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS				29,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 1,757,000
TOTAL COSTS				\$ 21,585,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE SA 6				
MOB/DEMOB DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	\$ 820
DUMP TRUCK	2	EA	385.00	770
BACK HOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
ROLLER	2	EA	785.00	1,570
				-
OFFICE TRAILER	1	MON	150.00	150
STORAGE TRAILER	1	MON	100.00	100
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	8	WK	25.00	200
WATER COOLER - 2 EA	8	WK	25.00	200
WATER	40	DAY	15.00	600
TELEPHONE SERVICE	1	MON	500.00	500
ELECTRICITY	1	MON	250.00	250
PICK-UP (2 EA)	2	MON	1000.00	2,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	MON	500.00	500
				-
SITE SUPERINTENDANT (1 MON * 210 HR/MON)	210	MNHR	65.00	13,650
FOREMEN (1 MON * 210 HR/MON)	210	MNHR	55.00	11,550
CLERK/TYPIST (1 MON * 168 HR/MON)	168	MNHR	25.00	4,200
				-
				-
				-
				-
				-
TOTAL MOB/DEMOB				\$ 41,280

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 6				
SITE PREPARATION & CAP CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 675 LF x 15' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	\$ 1,760
GRAVEL - 12" THICK	375	CY	10.00	3,750
SPREAD & COMPACT	0.5	DAY	1570.00	785
GEOFABRIC	1125	SY	1.00	1,125
CLEAR TREES FROM SITE	0.25	AC	6900.00	1,725
ARCHAEOLOGICAL SURVEY OF LANDFILL				-
PROJECT MANAGER	1	DAY	425.00	425
PRINCIPAL INVESTIGATOR	1	DAY	385.00	385
PROJECT ARCHAEOLOGIST	7	DAY	280.00	1,960
ASSISTANT ARCHAEOLOGIST	6	DAY	195.00	1,170
WORK PROCESSOR	1	DAY	185.00	185
ODCs	1	LS	100.00	100
MILAGE	1000	MILE	0.25	250
PER DIEM	5	DAY	60.00	300
UXO CLEARANCE	2	DAY	1800.00	3,600
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
TOTAL SITE PREPARATION				\$ 19,548
CAP CONSTRUCTION				
SUBGRADE SOIL	520	CY	10.00	\$ 5,200
TEXTURED GEOMEMBRANE	6750	SF	0.80	5,400
DRAINAGE SOIL	365	CY	17.00	6,205
GEOTEXTILE FABRIC LAYER	6750	SF	0.10	675
MOISTURE RETENTION SOIL	650	CY	10.00	6,500
VEGETATIVE SOIL	230	CY	14.00	3,220
SPREAD & COMPACT	3	DAY	1570.00	4,710
TOTAL CAP CONSTRUCTION				\$ 31,910

NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE SA 6				
SITE RESTORATION, MONITORING WELLS, INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE RESTORATION				
CHAIN LINK FENCE	400	LF	13.00	\$ 5,200
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	1000	SY	0.50	500
TOTAL SITE RESTORATION				\$ 6,500
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 6 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 41,280
TOTAL SITE PREPARATION				19,548
TOTAL CAP CONSTRUCTION				31,910
TOTAL SITE RESTORATION				6,500
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				31,762
TOTAL SA 6				\$ 159,000

JOB # 8712-04

DATE 24-Jan-97

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 12				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 300 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	80	CY	10.00	800
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	700	SY	1.00	700
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	325	LF	5.00	1,625
UXO CLEARANCE	15	DAY	1800.00	27,000
				-
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	2	DAY	1760.00	3,520
LABORER	16	HR	33.50	536
				-
TOTAL SITE PREPARATION				\$ 38,904
				-
CAP CONSTRUCTION				
SUBGRADE SOIL	9450	CY	10.00	\$ 94,500
TEXTURED GEOMEMBRANE	40950	SF	0.80	32,760
DRAINAGE SOIL	2050	CY	17.00	34,850
GEOTEXTILE FABRIC LAYER	40950	SF	0.10	4,095
MOISTURE RETENTION SOIL	3200	CY	10.00	32,000
VEGETATIVE SOIL	1150	CY	14.00	16,100
SPREAD & COMPACT	20	DAY	1570.00	31,400
				-
TOTAL CAP CONSTRUCTION				\$ 245,705
				-
NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
				-
				-
				-
				-
SITE RESTORATION				
CHAIN LINK FENCE	1000	LF	13.00	\$ 13,000
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
				-
TOTAL SITE RESTORATION				\$ 15,000
				-

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE SA 12 MONITORING WELLS & INSTITUTIONAL CONTROLS						
DESCRIPTION	QTY	UNIT	UNIT COST		TOTAL	
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$	18,000	
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$	10,000	

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 12 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 77,910
TOTAL SITE PREPARATION				38,904
TOTAL CAP CONSTRUCTION				245,705
TOTAL SITE RESTORATION				15,000
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				101,482
TOTAL SA 12				\$ 507,000

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE SA 13				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 200 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	450	SY	1.00	450
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	300	LF	5.00	1,500
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
TOTAL SITE PREPARATION				\$ 10,201
CAP CONSTRUCTION				
SUBGRADE SOIL	5600	CY	10.00	\$ 56,000
TEXTURED GEOMEMBRANE	42600	SF	0.80	34,080
DRAINAGE SOIL	2100	CY	17.00	35,700
GEOTEXTILE FABRIC LAYER	42600	SF	0.10	4,260
MOISTURE RETENTION SOIL	3350	CY	10.00	33,500
VEGETATIVE SOIL	1150	CY	14.00	16,100
SPREAD & COMPACT	16	DAY	1570.00	25,120
TOTAL CAP CONSTRUCTION				\$ 204,760
NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
SITE RESTORATION				
CHAIN LINK FENCE	900	LF	13.00	\$ 11,700
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	5300	SY	0.50	2,650
TOTAL SITE RESTORATION				\$ 15,150

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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CAP IN PLACE SA 13				
MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

CAP IN PLACE SA 13 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 58,230
TOTAL SITE PREPARATION				10,201
TOTAL CAP CONSTRUCTION				204,760
TOTAL SITE RESTORATION				15,150
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				78,660
TOTAL SA 13				\$ 395,000

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 41				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 350 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	270	CY	10.00	2,700
GEOFABRIC	800	SY	1.00	800
SPREAD & COMPACT	0.5	DAY	1570.00	785
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	150	LF	5.00	750
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
UXO CLEARANCE	2	DAY	1800.00	3,600
TOTAL SITE PREPARATION				\$ 14,993
CAP CONSTRUCTION				
SUBGRADE SOIL	625	CY	10.00	\$ 6,250
TEXTURED GEOMEMBRANE	10400	SF	0.80	8,320
DRAINAGE SOIL	565	CY	17.00	9,605
GEOTEXTILE FABRIC LAYER	10400	SF	0.10	1,040
MOISTURE RETENTION SOIL	990	CY	10.00	9,900
VEGETATIVE SOIL	300	CY	14.00	4,200
SPREAD & COMPACT	5	DAY	1570.00	7,850
TOTAL CAP CONSTRUCTION				\$ 47,165
NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
SITE RESTORATION				
CHAIN LINK FENCE	550	LF	13.00	\$ 7,150
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	1600	SY	0.50	800
TOTAL SITE RESTORATION				\$ 8,750

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 41 MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 41 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 41,280
TOTAL SITE PREPARATION				14,993
TOTAL CAP CONSTRUCTION				47,165
TOTAL SITE RESTORATION				8,750
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				34,812
TOTAL SA 13				\$ 175,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 9

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	32	EA	385.00	\$ 12,320
BACKHOE	4	EA	730.00	2,920
ROLLER	8	EA	785.00	6,280
OFFICE TRAILER	5	MON	150.00	750
STORAGE TRAILER	5	MON	100.00	500
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	44	WK	25.00	1,100
WATER COOLER - 2 EA	44	WK	25.00	1,100
WATER	220	DAY	15.00	3,300
TELEPHONE SERVICE	5	MON	500.00	2,500
ELECTRICITY	5	MON	250.00	1,250
PICK-UP (2 EA)	10	MON	1000.00	10,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
				-
SITE SUPERINTENDANT (5 MON * 210 HR/MON)	1050	MNHR	65.00	68,250
FOREMEN (5 MON * 210 HR/MON)	1050	MNHR	55.00	57,750
CLERK/TYPIST (5 MON * 168 HR/MON)	840	MNHR	25.00	21,000
				-
CLEAR TREES	2.5	AC	6900.00	17,250
				-
EROSION CONTROL	700	LF	5.00	3,500
				-
UXO CLEARANCE	70	DAY	1800.00	126,000
				-
				-
				-
EXCAVATION OF 112000 CY OF DEBRIS				-
BACKHOE & OPERATOR (2 EA)	140	DAY	1460.00	204,400
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & OPERATOR (16 EA)	1120	DAY	770.00	862,400
				-
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (4 EA)	280	DAY	1570.00	439,600
				-
				-
				-
TOTAL THIS PAGE				\$ 1,845,670

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 9

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 1,845,670
BACKFILL (112,000 * 1.3 = 145,600 CY REQUIRED)				
AVAILABLE FROM CONSOLIDATION LANDFILL EXCAVATION	88750	CY	0.00	0
LOAD STOCKPILED BACKFILL	110	DAY	825.00	90,750
HAUL & DUMP	330	DAY	770.00	254,100
				-
PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	56850	CY	10.00	568,500
				-
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT (2 EA)	182	DAY	1570.00	285,740
FERTILIZE, SEED, MULCH	36300	SY	0.50	18,150
WETLAND RESTORATION	0.1	AC	50000.00	5,000
				-
UNDEVELOPED DESIGN DETAILS ~25%				767,090
TOTAL AOC 9				\$ 3,835,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 11

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN AND OUT)				
DUMP TRUCKS	6	EA	385.00	\$ 2,310
BACKHOE	2	EA	730.00	1,460
ROLLER	4	EA	785.00	3,140
OFFICE TRAILER	3	MON	150.00	450
STORAGE TRAILER	3	MON	100.00	300
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	24	WK	25.00	600
WATER COOLER - 2 EA	24	WK	25.00	600
WATER	120	DAY	15.00	1,800
TELEPHONE SERVICE	3	MON	500.00	1,500
ELECTRICITY	3	MON	250.00	750
PICK-UP (2 EA)	3	MON	1000.00	3,000
				-
SITE SUPERINTENDANT (3 MON * 210 HR/MON)	630	MNHR	65.00	40,950
FOREMEN (3 MON * 210 HR/MON)	630	MNHR	55.00	34,650
CLERK/TYPIST (3 MON * 168 HR/MON)	504	MNHR	25.00	12,600
				-
ACCESS ROAD - 850 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	2	DAY	1760.00	3,520
GRAVEL - 12" THICK	650	CY	10.00	6,500
SPREAD & COMPACT	1	DAY	1570.00	1,570
GEOFABRIC	1900	SY	1.00	1,900
CLEAR TREES	0.5	AC	4300.00	2,150
				-
UXO CLEARANCE	45	DAY	1800.00	81,000
				-
				-
				-
EROSION CONTROL	900	LF	5.00	4,500
				-
EXCAVATION OF 35000 CY OF DEBRIS				-
BACKHOE & OPERATOR	45	DAY	1460.00	65,700
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & DRIVER	360	DAY	770.00	277,200
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (2 EA)	90	DAY	1570.00	141,300
				-
TOTAL THIS PAGE				\$ 690,450

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 11

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 690,450
REMOVE ACCESS ROAD				-
FRONT END LOADER & OPERATOR	2	DAY	825.00	1,650
DUMP TRUCK & DRIVER (2 EA)	4	DAY	785.00	3,140
LABORER (2 EA)	32	HR	33.50	1,072
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	45500	CY	10.00	455,000
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT (2 EA)	60	DAY	1570.00	94,200
FERTILIZE, SEED, MULCH	12100	SY	0.50	6,050
WETLAND RESTORATION	0.1	AC	50000.00	5,000
UNDEVELOPED DESIGN DETAILS ~25%				314,438
TOTAL AOC 11				\$ 1,571,000

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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JOB # 8712-04

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ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

[illegible]

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 40

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION				\$ 52,568
TOTAL MOBILIZATION				-
TOTAL SEDIMENT REMOVAL AND DISPOSAL				282,810
TOTAL DRUM REMOVAL AND DISPOSAL				-
TOTAL EXCAVATION AND BACKFILL				132,980
				-
				11,298
				-
				2,216,660
				-
UNDEVELOPED DESIGN DETAILS ~25%				673,685
TOTAL AOC 40				\$ 3,370,000

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JOB # 8712-04
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CONSOLIDATION LANDFILL CONSTRUCTION				
LINER CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

EXCAVATE LANDFILL BASE & BY-PASS DITCH				
BACK HOE & OPERATOR (2 EA)	126	DAY	1460.00	\$ 183,960
HAUL TO ON-SITE STOCKPILE (23250 CY)				
DUMP TRUCK & DRIVER (3 EA)	45	DAY	770.00	34,650
HAUL TO AOC-9 & STOCKPILE (88750 CY)				
DUMP TRUCK & DRIVER (16 EA)	880	DAY	770.00	677,600
DOZER & OPERATOR	55	DAY	1760.00	96,800
				-
CLAY	31850	CY	10.00	318,500
GEOMEMBRANE	330000	SF	0.65	214,500
FILTER FABRIC	330000	SF	0.10	33,000
10-2 SAND DRAINAGE LAYER	15925	CY	12.00	191,100
10-3 SAND DRAINAGE LAYER	15925	CY	17.00	270,725
ROLLER & OPERATOR	80	DAY	1570.00	125,600
				-
				-
DRAINAGE PIPING				-
6" DIA PERF PVC PIPE	2500	LF	6.00	15,000
12" DIA SOLID WALL PVC PIPE	1600	LF	15.00	24,000
6"x12" PVC WYE	5	EA	500.00	2,500
				-
LEACHATE PUMPING CHAMBER				-
5' DIA PRECAST MANHOLE	10	VLF	250.00	2,500
FRAME, COVER, ETC.	1	LS	300.00	300
CONCRETE FILL PAD, SUMP, ELECTRICAL	1	LS	35000.00	35,000
CONTROLS, ALARM, FILL PIPING, BOLLARDS				-
HAUL LEACHATE TO BASE TREATMENT PLANT	2600	HR	100.00	260,000
10 HR/DAY * 5 DAY/WK * 52 WK				-
				-
				-
				-
TOTAL LINER CONSTRUCTION				\$ 2,485,735

NOTE: ALL LINER SOIL MATERIAL QUANTITIES
 INCLUDE A 30% SWELL FACTOR

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 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
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JOB # 8712-04

DATE 24-Jan-97

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CONSOLIDATION LANDFILL CONSTRUCTION

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOBILIZATION				\$ 357,910
TOTAL SITE PREPARATION				115,500
TOTAL LINER CONSTRUCTION				2,485,735
TOTAL FINAL COVER CONSTRUCTION				1,232,875

UNDEVELOPED DESIGN DETAILS ~25%	1,047,980
TOTAL CONSOLIDATION LANDFILL CONSTRUCTION	\$ 5,240,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

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LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL O&M COSTS				
SA 6				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
				-
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
				-
				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC	12	SMPL	900.00	10,800
EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS				\$21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
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ANNUAL O&M COSTS				
SA 12				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
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=====				
ANNUAL O&M COSTS				
SA 13				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608

TOTAL ANNUAL O&M COSTS			\$	21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
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 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
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ANNUAL O&M COSTS				
AOC 41				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
				-
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
				-
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
				-
				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM				
PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED				
	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED				
	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
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ANNUAL O&M COSTS				
SUMMARY SHEET FOR CAP IN PLACE OPTIONS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

ANNUAL O&M COSTS - FOR 30 YEARS				
TOTAL SA 6				\$ 21,842
TOTAL SA 12				21,842
TOTAL SA 13				21,842
TOTAL AOC 41				21,842
UNDEVELOPED DESIGN DETAILS ~25%				21,632

TOTAL ANNUAL O&M COSTS - 30 YEARS				\$ 109,000

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 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40
 LOCATION: DEVENS, MASSACHUSETTS
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ANNUAL O&M COSTS CONSOLIDATION LANDFILL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS OCCURRING OVER THIRTY YEARS FOR CONSOLIDATION LANDFILL				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	10000.00	\$ 1,810
				-
ENVIRONMENTAL MONITORING				-
GROUNDWATER, 4 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	8	SMPL	940.00	7,520
				-
LANDFILL COVER MAINTENANCE				-
INSPECTION - 2 DAY @ 2 MEN/DAY	32	MNHR	75.00	2,400
GENERAL REPAIR				-
DUMP TRUCK & DRIVER	1	DAY	770.00	770
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
MOWING	2	EVENT	1000.00	2,000
				-
BI-ANNUAL REPORT TO DEP - ANNUALIZED	0.4878	LS	2500.00	1,220
AYER WWTP USER FEE	600	CCF	2.00	1,200
UNDEVELOPED DESIGN DETAILS ~25%				4,220

TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 23,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13 AND AOC 41;
 EXCAVATE AND CONSOLIDATE AOCs 9, 11, 40

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ANNUAL O&M COSTS AOC 40

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER FIVE YEARS FOR CSB LANDFILL				
SEDIMENT, 2 SAMPLES AT 2 LOCATIONS, ONE TIME ONLY AT YEAR 5				
METALS - ANNUALIZED	0.7239	SMPL	625.00	\$ 452
GROUNDWATER MONITORING, 2 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	4	SMPL	1020.00	4,080
SAMPLE COLLECTION (INCLUDES WELL	2	LS	2500	5,000
PURGE, SAMPLE COLLECTION, AND SHIPMENT)				-
WETLANDS RESTORATION MONITORING				-
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	2,400
BIO MONITORING, BI-ANNUALLY	0.4878	LS	15000.00	7,317
FIVE YEAR EDUCATION PROGRAM ONCE	0.1810	LS	2500.00	452
PUBLIC MEETING - ANNUALIZED				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	20000.00	3,619
UNDEVELOPED DESIGN DETAILS ~25%				5,679
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				\$ 29,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

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COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
SA 6				\$ 159,000
AOC 9				3,301,000
AOC 11				1,269,000
SA 12				507,000
SA 13				395,000
AOC 40				1,758,000
AOC 41				175,000
TOTAL DIRECT COSTS				\$ 7,564,000
INDIRECT COSTS				
HEALTH AND SAFETY			5.00%	\$ 378,000
LEGAL, ADMIN, PERMITTING			5.00%	378,000
ENGINEERING			10.00%	756,000
SERVICES DURING CONSTRUCTION			10.00%	756,000
TOTAL INDIRECT COSTS				\$ 2,268,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 9,832,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS - 30 YEARS				\$ 208,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS				\$ 13,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 2,634,000
TOTAL COSTS				\$ 12,466,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
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CAP IN PLACE SA 6				
MOB/DEMOB DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	\$ 820
DUMP TRUCK	2	EA	385.00	770
BACK HOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
ROLLER	2	EA	785.00	1,570
				-
OFFICE TRAILER	1	MON	150.00	150
STORAGE TRAILER	1	MON	100.00	100
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	8	WK	25.00	200
WATER COOLER - 2 EA	8	WK	25.00	200
WATER	40	DAY	15.00	600
TELEPHONE SERVICE	1	MON	500.00	500
ELECTRICITY	1	MON	250.00	250
PICK-UP (2 EA)	2	MON	1000.00	2,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	MON	500.00	500
				-
SITE SUPERINTENDANT (1 MON * 210 HR/MON)	210	MNHR	65.00	13,650
FOREMEN (1 MON * 210 HR/MON)	210	MNHR	55.00	11,550
CLERK/TYPIST (1 MON * 168 HR/MON)	168	MNHR	25.00	4,200
				-
				-
				-
				-
				-
TOTAL MOB/DEMOB				\$ 41,280

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
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 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
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CAP IN PLACE SA 6				
SITE PREPARATION & CAP CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 675 LF x 15' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	\$ 1,760
GRAVEL - 12" THICK	375	CY	10.00	3,750
SPREAD & COMPACT	0.5	DAY	1570.00	785
GEOFABRIC	1125	SY	1.00	1,125
CLEAR TREES FROM SITE	0.25	AC	6900.00	1,725
ARCHAEOLOGICAL SURVEY OF LANDFILL				-
PROJECT MANAGER	1	DAY	425.00	425
PRINCIPAL INVESTIGATOR	1	DAY	385.00	385
PROJECT ARCHAEOLOGIST	7	DAY	280.00	1,960
ASSISTANT ARCHAEOLOGIST	6	DAY	195.00	1,170
WORK PROCESSOR	1	DAY	185.00	185
ODCs	1	LS	100.00	100
MILAGE	1000	MILE	0.25	250
PER DIEM	5	DAY	60.00	300
UXO CLEARANCE	2	DAY	1800.00	3,600
GRADING & DRAINAGE SWALE CONSTRUCTION				-
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
TOTAL SITE PREPARATION				\$ 19,548
CAP CONSTRUCTION				
SUBGRADE SOIL	520	CY	10.00	\$ 5,200
TEXTURED GEOMEMBRANE	6750	SF	0.80	5,400
DRAINAGE SOIL	365	CY	17.00	6,205
GEOTEXTILE FABRIC LAYER	6750	SF	0.10	675
MOISTURE RETENTION SOIL	650	CY	10.00	6,500
VEGETATIVE SOIL	230	CY	14.00	3,220
SPREAD & COMPACT	3	DAY	1570.00	4,710
TOTAL CAP TOTAL CAP CONSTRUCTION				\$ 31,910

NOTE: CAP NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
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CAP IN PLACE SA 6				
SITE RESTORATION, MONITORING WELLS, INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE RESTORATION				
CHAIN LINK FENCE	400	LF	13.00	\$ 5,200
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	1000	SY	0.50	500
TOTAL SITE RESTORATION				\$ 6,500
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
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ESTIMATOR: P. R. MARTIN

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CAP IN PLACE SA 6 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 41,280
TOTAL SITE PREPARATION				19,548
TOTAL CAP CONSTRUCTION				31,910
TOTAL SITE RESTORATION				6,500
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				31,762
TOTAL SA 6				\$ 159,000

ESTIMATOR: P. R. MARTIN

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[illegible]

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS

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ESTIMATOR: P. R. MARTIN

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CAP IN PLACE AOC 9				
SITE PREPARATION, DEBRIS EXCAVATION, & CAP CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

SITE PREPARATION				
ACCESS ROAD - 500 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	\$ 1,760
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT - ROLLER & OPERATOR	0.5	DAY	1570.00	785
GEOFABRIC	1100	SY	1.00	1,100
CLEAR TREES FROM SITE	3	AC	6900.00	20,700
EROSION CONTROL	700	LF	5.00	3,500
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	10	DAY	1760.00	17,600
LABORER	80	HR	33.50	2,680
TOTAL SITE PREPARATION				\$ 52,125

EXCAVATE DEBRIS AREA I, II, III, & IV & PLACE IN AREA V				
BACKHOE & OPERATOR	30	DAY	1460.00	\$ 43,800
LABORER	240	HR	33.50	8,040
DUMP TRUCK & DRIVER - 3 EA	90	DAY	770.00	69,300
DOZER & OPERATOR	30	DAY	1760.00	52,800
LABORER	240	HR	33.50	8,040
TOTAL EXCAVATE DEBRIS				\$ 181,980

CAP CONSTRUCTION				
SUBGRADE SOIL	50800	CY	10.00	\$ 508,000
TEXTURED GEOMEMBRANE	371000	SF	0.80	296,800
DRAINAGE SOIL	18200	CY	17.00	309,400
GEOTEXTILE FABRIC LAYER	371000	SF	0.10	37,100
MOISTURE RETENTION SOIL	28200	CY	10.00	282,000
VEGETATIVE SOIL	9500	CY	14.00	133,000
SPREAD & COMPACT - ROLLER & OPERATOR	132	DAY	1570.00	207,240
TOTAL CAP CONSTRUCTION				\$ 1,773,540

NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 9				
SITE RESTORATION, MONITORING WELLS, & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE RESTORATION				
DEBRIS AREA I - IV FILL MATERIAL	25250	CY	10.00	\$ 252,500
DEBRIS AREA I - IV VEGETATIVE SOIL	2700	CY	14.00	37,800
CHAIN LINK FENCE	2500	LF	13.00	32,500
12' SWING GATE	2	EA	800.00	1,600
FERTILIZE, SEED, MULCH	62000	SY	0.50	31,000
SPREAD & COMPACT - ROLLER & OPERATOR	35	DAY	1570.00	54,950
TOTAL SITE RESTORATION				\$ 410,350
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04
DATE 24-Jan-97

CAP IN PLACE AOC 9 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 194,600
TOTAL SITE PREPARATION				52,125
TOTAL DEBRIS EXCAVATION				181,980
TOTAL CAP CONSTRUCTION				1,773,540
TOTAL SITE RESTORATION				410,350
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				660,405
TOTAL AOC 9				\$ 3,301,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 11				
MOB/DEMOB DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	\$ 820
DUMP TRUCK	2	EA	385.00	770
BACK HOE	2	EA	730.00	1,460
DOZER (2 EA)	4	EA	880.00	3,520
ROLLER (2 EA)	4	EA	785.00	3,140
OFFICE TRAILER	3	MON	150.00	450
STORAGE TRAILER	3	MON	100.00	300
SET UP TRAILER	2	EA	500.00	1,000
TOILET - 2 EA	24	WK	25.00	600
WATER COOLER - 2 EA	24	WK	25.00	600
WATER	60	DAY	15.00	900
TELEPHONE SERVICE	3	MON	500.00	1,500
ELECTRICITY	3	MON	250.00	750
PICK-UP (2 EA)	6	MON	1000.00	6,000
PUMPS, TOOLS, MINOR EQUIPMENT	3	MON	500.00	1,500
SITE SUPERINTENDANT (3 MON * 210 HR/MON)	630	MNHR	65.00	40,950
FOREMEN (3 MON * 210 HR/MON)	630	MNHR	55.00	34,650
CLERK/TYPIST (3 MON * 168 HR/MON)	504	MNHR	25.00	12,600
TOTAL MOB/DEMOB				\$ 111,510

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 11				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 850 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	2	DAY	1760.00	\$ 3,520
GRAVEL - 12" THICK	650	CY	10.00	6,500
SPREAD & COMPACT	1	DAY	1570.00	1,570
GEOFABRIC	1900	SY	2.00	3,800
CLEAR TREES FROM SITE	0.5	AC	4300.00	2,150
EROSION CONTROL	900	LF	5.00	4,500
				-
				-
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	3	DAY	1760.00	5,280
LABORER	24	HR	33.50	804
				-
TOTAL SITE PREPARATION				\$ 28,124
CAP CONSTRUCTION				
SUBGRADE SOIL	23550	CY	10.00	\$ 235,500
TEXTURED GEOMEMBRANE	115650	SF	0.80	92,520
DRAINAGE SOIL	5900	CY	17.00	100,300
GEOTEXTILE FABRIC LAYER	115650	SF	0.10	11,565
MOISTURE RETENTION SOIL	9220	CY	10.00	92,200
RIPRAP	7450	CY	30.00	223,500
SPREAD & COMPACT	45	DAY	1570.00	70,650
				-
TOTAL CAP CONSTRUCTION				\$ 826,235
NOTE: ALL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
				-
				-
				-
SITE RESTORATION				
CHAIN LINK FENCE	1600	LF	13.00	\$ 20,800
12' SWING GATE	1	EA	800.00	800
				-
TOTAL SITE RESTORATION				\$ 21,600
				-
				-
				-

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 11 MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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ESTIMATOR: P. R. MARTIN

DATE 24-Jan-97

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE SA 12				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 300 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	80	CY	10.00	800
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	700	SY	1.00	700
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	325	LF	5.00	1,625
UXO CLEARANCE	15	DAY	1800.00	27,000
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	2	DAY	1760.00	3,520
LABORER	16	HR	33.50	536
TOTAL SITE PREPARATION				\$ 38,904
CAP CONSTRUCTION				
SUBGRADE SOIL	9450	CY	10.00	\$ 94,500
TEXTURED GEOMEMBRANE	40950	SF	0.80	32,760
DRAINAGE SOIL	2050	CY	17.00	34,850
GEOTEXTILE FABRIC LAYER	40950	SF	0.10	4,095
MOISTURE RETENTION SOIL	3200	CY	10.00	32,000
VEGETATIVE SOIL	1150	CY	14.00	16,100
SPREAD & COMPACT	20	DAY	1570.00	31,400
TOTAL CAP CONSTRUCTION				\$ 245,705
NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
SITE RESTORATION				
CHAIN LINK FENCE	1000	LF	13.00	\$ 13,000
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
TOTAL SITE RESTORATION				\$ 15,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04
DATE 24-Jan-97

CAP IN PLACE SA 12 MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE SA 12 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 77,910
TOTAL SITE PREPARATION				38,904
TOTAL CAP CONSTRUCTION				245,705
TOTAL SITE RESTORATION				15,000
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				101,482
TOTAL SA 12				\$ 507,000

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE SA 13				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 200 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	450	SY	1.00	450
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	300	LF	5.00	1,500
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
TOTAL SITE PREPARATION				\$ 10,201
CAP CONSTRUCTION				
SUBGRADE SOIL	5600	CY	10.00	\$ 56,000
TEXTURED GEOMEMBRANE	42100	SF	0.80	33,680
DRAINAGE SOIL	2100	CY	17.00	35,700
GEOTEXTILE FABRIC LAYER	42100	SF	0.10	4,210
MOISTURE RETENTION SOIL	3350	CY	10.00	33,500
VEGETATIVE SOIL	1150	CY	14.00	16,100
SPREAD & COMPACT	16	DAY	1570.00	25,120
TOTAL CAP CONSTRUCTION				\$ 204,310
NOTE: SOIL CAP MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.				
SITE RESTORATION				
CHAIN LINK FENCE	900	LF	13.00	\$ 11,700
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	5300	SY	0.50	2,650
TOTAL SITE RESTORATION				\$ 15,150

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04
DATE 24-Jan-97

CAP IN PLACE SA 13 MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04
DATE 24-Jan-97

CAP IN PLACE SA 13 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 58,230
TOTAL SITE PREPARATION				10,201
TOTAL CAP CONSTRUCTION				204,310
TOTAL SITE RESTORATION				15,150
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				79,110
TOTAL SA 13				\$ 395,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40 SITE PREPARATION AND MOBILIZATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD SEDIMENT AREA 1				
CLEAR & GRUB LIGHT VEGETATION	0.1	AC	4300.00	\$ 430
GRADE- DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 12" THICK	360	CY	10.00	3,600
FILTER FABRIC	550	SY	1.00	550
SPREAD & COMPACT	0.5	DAY	1570.00	785
ACCESS ROAD SEDIMENT AREA 2				
CLEAR & GRUB LIGHT VEGETATION	0.1	AC	4300.00	430
GRADE- DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 24" THICK	340	CY	10.00	3,400
SPREAD & COMPACT	0.5	DAY	1570.00	785
FILTER FABRIC	550	SY	1.00	550
ACCESS ROAD FOR CAPPING - 500 LF				-
CLEAR & GRUB LIGHT VEGETATION	0.35	AC	4300.00	1,505
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 24" THICK	1450	CY	10.00	14,500
FILTER FABRIC	2000	SY	1.00	2,000
SPREAD & COMPACT	2	DAY	1570.00	3,140
PARKING AREA				
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
SEDIMENT DEWATERING PAD				-
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE- DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
LINER	10000	SF	0.60	6,000
SUMP & SUMP PUMP	1	LS	2500.00	2,500
DECON AREA - 10'x20'	3	EA	1000.00	3,000
				-
				-
				-
				-
				-
CAP MATERIALS STOCKPILE AREA				-
CLEAR & GRUB LIGHT VEGETATION	1	AC	4300.00	4,300
GRADE- DOZER & OPERATOR	2	DAY	1760.00	3,520
TOTAL THIS PAGE				\$ 61,450

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40 SITE PREPARATION AND MOBILIZATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				\$ 61,450
MOBILIZATION				
EQUIPMENT (IN OR OUT)				
FRONT END LOADER	2	EA	410.00	820
DUMP TRUCK	6	EA	385.00	2,310
BACKHOE	2	EA	730.00	1,460
DOZER	2	EA	880.00	1,760
CRANE & CLAMSHELL BUCKET	2	EA	640.00	1,280
ROLLER	2	EA	785.00	1,570
FRAC TANK	4	EA	250.00	1,000
DEWATERING PUMP & HOSE	2	EA	100.00	200
OFFICE TRAILER	4	MON	150.00	600
STORAGE TRAILER	4	MON	150.00	600
TRAILER DELIVERY, SET-UP, REMOVAL	2	EA	300.00	600
TOILET - 2 EA	36	WK	25.00	900
WATER COOLER - 2 EA	36	WK	25.00	900
WATER	180	DAY	15.00	2,700
TELEPHONE SERVICE	4	MON	500.00	2,000
ELECTRICITY	4	MON	250.00	1,000
PICK-UP (2 EA)	8	MON	1000.00	8,000
OFFICE EQUIPMENT	4	MON	1000.00	4,000
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
LABORER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	33.50	5,360
CARPENTER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	48.00	7,680
ELECTRICIAN (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	50.50	8,080
SITE SUPERINTENDANT (4 MON*210HR/MON)	840	MNHR	65.00	54,600
FOREMAN (4 MON*210HR/MON)	840	MNHR	55.00	46,200
CLERK/TYPIST (4 MON*168HR/MON)	672	MNHR	25.00	16,800
				-
				-
				-
				-
TOTAL SITE PREPARATION AND MOBILIZATION				\$ 234,370

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ESTIMATOR: P. R. MARTIN

DATE 24-Jan-97

TOTAL DRUM REMOVAL AND DISPOSAL

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

CAP IN PLACE AOC 40				
CAP CONSTRUCTION, INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CAP CONSTRUCTION				
SILT FENCE ALONG TOE OF LANDFILL	1500	LF	5.00	\$ 7,500
CLEAR & GRUB SITE	4.4	AC	6900.00	30,360
LONG STICK EXCAVATOR	5	DAY	1750.00	8,750
GRADE SITE - DOZER & OPERATOR	5	DAY	1760.00	8,800
CUT LANDFILL WASTE WITH DOZER	7	DAY	1760.00	12,320
IMPORTED FILL	2500	CY	10.00	25,000
SPREAD & COMPACT WASTE & FILL	14	DAY	1570.00	21,980
SUBGRADE FILL	7100	CY	10.00	71,000
SPREAD & COMPACT SUBGRADE FILL	9	DAY	1570.00	14,130
TEXTURED GEOMEMBRANE	192000	SF	0.80	153,600
10-3 SAND DRAINAGE LAYER	9250	CY	17.00	157,250
SPREAD & COMPACT DRAINAGE LAYER	13	DAY	1570.00	20,410
GEOTEXTILE FILTER FABRIC	192000	SF	0.10	19,200
MOISTURE RETENTION LAYER	13900	CY	10.00	139,000
SPREAD & COMPACT MOISTURE RETENTION LAYER	18	DAY	1570.00	28,260
VEGETATIVE MATERIAL	4600	CY	14.00	64,400
SPREAD & COMPACT VEGETATIVE LAYER	6	DAY	1570.00	9,420
SEED, FERTILIZE, MULCH	4.4	AC	2000.00	8,800
RIPRAP	2250	CY	30.00	67,500
GUARD RAIL ALONG ROAD	1000	LF	12.50	12,500
TOTAL CAP CONSTRUCTION				\$ 880,180
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04
DATE 24-Jan-97

CAP IN PLACE AOC 40 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION AND MOBILIZATION				\$ 234,370
TOTAL SEDIMENT REMOVAL & DISPOSAL				186,610
TOTAL WETLAND RESTORATION				75,000
TOTAL MONITORING WELLS				9,000
TOTAL DRUM REMOVAL & DISPOSAL				11,098
TOTAL COVER PLACEMENT				880,180
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				351,742
TOTAL SA 13				\$ 1,758,000

JOB # 8712-04
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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

CAP IN PLACE AOC 41				
SITE PREPARATION, CAP CONSTRUCTION, SITE RESTORATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
SITE PREPARATION				
ACCESS ROAD - 350 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	\$ 880
GRAVEL - 12" THICK	270	CY	10.00	2,700
GEOFABRIC	800	SY	1.00	800
SPREAD & COMPACT	0.5	DAY	1570.00	785
CLEAR TREES FROM SITE	0.5	AC	6900.00	3,450
EROSION CONTROL	150	LF	5.00	750
GRADING & DRAINAGE SWALE CONSTRUCTION				
DOZER & OPERATOR	1	DAY	1760.00	1,760
LABORER	8	HR	33.50	268
UXO CLEARANCE	2	DAY	1800.00	3,600
TOTAL SITE PREPARATION				\$ 14,993

CAP CONSTRUCTION				
SUBGRADE SOIL	625	CY	10.00	\$ 6,250
TEXTURED GEOMEMBRANE	10400	SF	0.80	8,320
DRAINAGE SOIL	565	CY	17.00	9,605
GEOTEXTILE FABRIC LAYER	10400	SF	0.10	1,040
MOISTURE RETENTION SOIL	990	CY	10.00	9,900
VEGETATIVE SOIL	300	CY	14.00	4,200
SPREAD & COMPACT	5	DAY	1570.00	7,850
TOTAL CAP CONSTRUCTION				\$ 47,165

NOTE: CAP SOIL MATERIAL QUANTITIES INCLUDE A 30% SWELL FACTOR.

SITE RESTORATION				
CHAIN LINK FENCE	550	LF	13.00	\$ 7,150
12' SWING GATE	1	EA	800.00	800
FERTILIZE, SEED, MULCH	1600	SY	0.50	800
TOTAL SITE RESTORATION				\$ 8,750

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

CAP IN PLACE AOC 41 MONITORING WELLS & INSTITUTIONAL CONTROLS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MONITORING WELLS - 4" DIA x 30' DEEP	4	EA	4500.00	\$ 18,000
INSTITUTIONAL CONTROLS	1	LS	10000.00	\$ 10,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 7: CAP-IN-PLACE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04
DATE 24-Jan-97

CAP IN PLACE AOC 41 SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL MOB/DEMOB				\$ 41,280
TOTAL SITE PREPARATION				14,993
TOTAL CAP CONSTRUCTION				47,165
TOTAL SITE RESTORATION				8,750
TOTAL MONITORING WELLS				18,000
TOTAL INSTITUTIONAL CONTROLS				10,000
UNDEVELOPED DESIGN DETAILS ~25%				34,812
TOTAL SA 13				\$ 175,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
ANNUAL O&M COSTS				
SA 6				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
-				
TOTAL ANNUAL O&M COSTS				\$21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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ANNUAL O&M COSTS				
AOC 9				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
FRONT END LOADER & OPER	2	DAY	825.00	1,650
LABORER - 2 EA	32	MNHR	33.50	1,072
MATERIALS	1	LS	1000.00	1,000
INSPECTION - 1 DAY @ 2 MEN/DAY	16	MNHR	75.00	1,200
MOWING - TRACTOR & OPERATOR	5	DAY	500.00	2,500
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 27,323

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

ANNUAL O&M COSTS				
AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS	12	SMPL	900.00	10,800
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				-
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				-
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 21,592

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

ANNUAL O&M COSTS				
SA 12				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS	12	SMPL	900.00	10,800
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				-
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				-
TWO YEAR DATA REPORT TO MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

ANNUAL O&M COSTS				
SA 13				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION	2	LS	1800.00	3,600
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)				-
GROUNDWATER SAMPLE ANALYSIS				-
4 SAMPLES PLUS 2 SAMPLE QA/QC	12	SMPL	900.00	10,800
EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS				-
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				-
TWO YEAR DATA REPORT TO	0.4831	LS	1000.00	483
MADEP - ANNUALIZED				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

ANNUAL O&M COSTS AOC 40				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURING OVER FIVE YEARS				
WETLANDS RESTORATION MONITORING (5 YEARS)				
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	\$ 2,400
BIOMONITORING, BIENNIALY				-
FOR 5 YEARS	0.4831	LS	15000.00	7,246
FIVE YEAR SITE REVIEW - ANNUALIZED				-
	0.1739	LS	2500.00	435
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				\$ 10,081

O&M COSTS OCCURING OVER THIRTY YEARS				
LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
MOWING - TRACTOR & OPERATOR	1	DAY	500.00	500
SUBTOTAL THIS PAGE				\$ 3,731

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
ANNUAL O&M COSTS				
AOC 40				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER THIRTY YEARS - TOTAL FROM PREVIOUS PAGE				\$ 3,731
ENVIRONMENTAL MONITORING				
SEDIMENT SAMPLE COLLECTION	0.1739	LS	1200.00	209
4 LOCATIONS, ONCE EVERY 5 YEARS				-
SEDIMENT SAMPLE ANALYSIS,	0.8695	SMPL	715.00	622
ONCE EVERY 5 YEARS, 4 SAMPLES PLUS 1 QA/QC,				-
SVOCs AND INORGANICS ANNUALIZED				-
				-
				-
GROUNDWATER SAMPLE COLLECTION	2	LS	2700.00	5,400
7 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE,				-
SAMPLE COLLECTION, AND SHIPPING)				-
				-
GROUNDWATER SAMPLE ANALYSIS				
7 SAMPLES PLUS 2 SAMPLE QA/QC	18	SMPL	900.00	16,200
EQUIVALENT SEMI-ANNUALLY, SVOCs,				
INORGANICS, WATER QUALITY PARAMETERS				
FIVE YEAR EDUCATIONAL PROGRAM	0.1739	LS	5000.00	869
PUBLIC MEETING - ANNUALIZED				
TWO YEAR DATA REPORT TO	0.4831	LS	1000.00	483
MADEP - ANNUALIZED				-
				-
				-
				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 30,122
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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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ANNUAL O&M COSTS				
AOC 41				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

LANDFILL COVER MAINTENANCE				
GENERAL REPAIR				
DUMP TRUCK & DRIVER	1	DAY	770.00	\$ 770
FRONT END LOADER & OPER	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
				-
INSPECTION - 0.5 DAY @ 2 MEN/DAY	8	MNHR	75.00	600
				-
MOWING - TRACTOR & OPERATOR	0.5	DAY	500.00	250
ENVIRONMENTAL MONITORING				
GROUNDWATER SAMPLE COLLECTION				
4 WELLS, SEMI-ANNUALLY (INCLUDES WELL PURGE, SAMPLE COLLECTION, AND SHIPPING)	2	LS	1800.00	3,600
				-
				-
GROUNDWATER SAMPLE ANALYSIS				
4 SAMPLES PLUS 2 SAMPLE QA/QC EQUIVALENT SEMI-ANNUALLY, SVOCs, INORGANICS, WATER QUALITY PARAMETERS	12	SMPL	900.00	10,800
FIVE YEAR EDUCATIONAL PROGRAM				
PUBLIC MEETING - ANNUALIZED	0.1739	LS	5000.00	869
TWO YEAR DATA REPORT TO				
MADEP - ANNUALIZED	0.4831	LS	1000.00	483
FIVE YEAR SITE REVIEW - ANNUALIZED				
	0.1739	LS	15000.00	2,608
				-
TOTAL ANNUAL O&M COSTS				\$ 21,842

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 7: CAP-IN-PLACE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

ANNUAL O&M COSTS SUMMARY SHEET				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
ANNUAL O&M COSTS - FOR 30 YEARS				
TOTAL SA 6				\$ 21,842
TOTAL AOC 9				27,323
TOTAL AOC 11				21,592
TOTAL SA 12				21,842
TOTAL SA 13				21,842
TOTAL AOC 40				30,122
TOTAL AOC 41				21,842
UNDEVELOPED DESIGN DETAILS ~25%				41,595
TOTAL ANNUAL O&M COSTS - 30 YEARS				\$ 208,000
ADDITIONAL ANNUAL O&M COSTS - FOR 5 YEARS				
TOTAL AOC 40				\$ 10,081
UNDEVELOPED DESIGN DETAILS ~25%				2,919
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				\$ 13,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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COST SUMMARY TABLE

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
LIMITED REMOVAL AT AOC 11				\$ 44,000
EXCAVATE AND CONSOLIDATE				
SA 6				64,000
AOC 9				3,835,000
SA 12				490,000
SA 13				502,000
AOC 40				3,370,000
AOC 41				93,000
CONSOLIDATION LANDFILL CONSTRUCTION				5,240,000
TOTAL DIRECT COSTS				\$ 13,638,000
INDIRECT COSTS				
HEALTH AND SAFETY		5.00%	\$	682,000
LEGAL, ADMIN, PERMITTING		5.00%		682,000
ENGINEERING		10.00%		1,364,000
SERVICES DURING CONSTRUCTION		10.00%		1,364,000
TOTAL INDIRECT COSTS				\$ 4,092,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$ 17,730,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR AOC 11 FOR 2 YRS			\$	4,000
TOTAL ANNUAL O&M COSTS FOR NEW LANDFILL FOR 30 YRS			\$	23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS			\$	29,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 411,000
TOTAL COSTS				\$ 18,141,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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LIMITED REMOVAL AND DISPOSAL IN CONSOLIDATION LANDFILL AOC 11

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 22,945
BACKFILL				
PURCHASED FROM OFF-SITE	625	CY	10.00	6,250
(INCLUDING 30% SWELL FACTOR)				-
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	2	DAY	1570.00	3,140
FERTILIZE, SEED, MULCH	5000	SY	0.50	2,500
				-
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				9,165
TOTAL AOC 11				\$ 44,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE SA 6

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB				
BACKHOE TO SA 6	2	EA	730.00	\$ 1,460
DOZER & ROLLER TO SA 6	2	EA	660.00	1,320
DUMP TRUCK	6	EA	385.00	2,310
ACCESS ROAD - 675 LF x 15' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	1,760
GRAVEL - 12" THICK	1125	SY	5.00	5,625
GEOFABRIC	1125	SY	2.00	2,250
CLEAR TREES FROM SITE	0.25	AC	6000.00	1,500
ARCHAEOLOGICAL SURVEY OF LANDFILL				
PROJECT MANAGER	1	DAY	405.00	405
PRINCIPAL INVESTIGATOR	1	DAY	365.00	365
PROJECT ARCHAEOLOGIST	7	DAY	265.00	1,855
ASSISTANT ARCHAEOLOGIST	6	DAY	185.00	1,110
WORK PROCESSOR	1	DAY	175.00	175
ODCs	1	LS	100.00	100
MILAGE	1000	MILE	0.25	250
PER DIEM	5	DAY	60.00	300
UXO CLEARANCE	2	DAY	1800.00	3,600
FOREMAN	100	HR	55.00	5,500
EXCAVATION & HAULING				
BACKHOE & OPERATOR	2	DAY	1460.00	2,920
LABORER	16	HR	33.50	536
DUMP TRUCK & DRIVER - 3 EA	6	DAY	770.00	4,620
SPREAD & COMPACT AT ON-SITE CONSOLIDATION LANDFILL (INLC 50% SWELL FACTOR)				
ROLLER & OPERATOR	2	DAY	1570.00	3,140
REMOVE ACCESS ROAD (~70 LF)				
BACKHOE & OPERATOR	0.5	DAY	1460.00	730
DUMP TRUCK & DRIVER	0.5	DAY	770.00	385
LABORER	4	HR	33.50	134
TOTAL THIS PAGE				\$ 42,350

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE SA 6

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 42,350
BACKFILL PURCHASED FORM OFF-SITE (INCLUDING 30% SWELL FACTOR)	650	CY	10.00	6,500
				-
				-
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	1	DAY	1570.00	1,570
FERTILIZE, SEED, MULCH	1200	SY	0.50	600
				-
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				12,980
TOTAL SA 6				\$ 64,000

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 9

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	32	EA	385.00	\$ 12,320
BACKHOE	4	EA	730.00	2,920
ROLLER	8	EA	785.00	6,280
OFFICE TRAILER	5	MON	150.00	750
STORAGE TRAILER	5	MON	100.00	500
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	44	WK	25.00	1,100
WATER COOLER - 2 EA	44	WK	25.00	1,100
WATER	220	DAY	15.00	3,300
TELEPHONE SERVICE	5	MON	500.00	2,500
ELECTRICITY	5	MON	250.00	1,250
PICK-UP (2 EA)	10	MON	1000.00	10,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
				-
SITE SUPERINTENDANT (5 MON * 210 HR/MON)	1050	MNHR	65.00	68,250
FOREMEN (5 MON * 210 HR/MON)	1050	MNHR	55.00	57,750
CLERK/TYPIST (5 MON * 168 HR/MON)	840	MNHR	25.00	21,000
				-
CLEAR TREES	2.5	AC	6900.00	17,250
				-
EROSION CONTROL	700	LF	5.00	3,500
				-
UXO CLEARANCE	70	DAY	1800.00	126,000
				-
				-
				-
EXCAVATION OF 112000 CY OF DEBRIS				-
BACKHOE & OPERATOR (2 EA)	140	DAY	1460.00	204,400
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & OPERATOR (16 EA)	1120	DAY	770.00	862,400
				-
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (4 EA)	280	DAY	1570.00	439,600
				-
				-
TOTAL THIS PAGE				\$ 1,845,670

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 9

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 1,845,670
BACKFILL (112,000 * 1.3 = 145,600 CY REQUIRED)				
AVAILABLE FROM CONSOLIDATION LANDFILL EXCAVATION	88750	CY	0.00	0
LOAD STOCKPILED BACKFILL	110	DAY	825.00	90,750
HAUL & DUMP	330	DAY	770.00	254,100
PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	56850	CY	10.00	568,500
SITE RESTORATION				
BACKFILL, GRADE, COMPACT (2 EA)	182	DAY	1570.00	285,740
FERTILIZE, SEED, MULCH	36300	SY	0.50	18,150
WETLAND RESTORATION	0.1	AC	50000.00	5,000
UNDEVELOPED DESIGN DETAILS ~25%				767,090
TOTAL AOC 9				\$ 3,835,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE SA 12

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	10	EA	385.00	\$ 3,850
BACKHOE	2	EA	730.00	1,460
ROLLER	2	EA	785.00	1,570
OFFICE TRAILER	1.5	MON	150.00	225
STORAGE TRAILER	1.5	MON	100.00	150
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	12	WK	25.00	300
WATER COOLER - 2 EA	12	WK	25.00	300
WATER	60	DAY	15.00	900
TELEPHONE SERVICE	1.5	MON	500.00	750
ELECTRICITY	1.5	MON	250.00	375
PICK-UP (2 EA)	3	MON	1000.00	3,000
				-
SITE SUPERINTENDANT (1.5 MON * 210 HR/MON)	315	MNHR	65.00	20,475
FOREMEN (1.5 MON * 210 HR/MON)	315	MNHR	55.00	17,325
CLERK/TYPIST (1.5 MON * 168 HR/MON)	252	MNHR	25.00	6,300
				-
ACCESS ROAD - 300 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	250	CY	10.00	2,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	700	SY	1.00	700
CLEAR TREES	0.5	AC	6900.00	3,450
				-
EROSION CONTROL	325	LF	5.00	1,625
				-
UXO CLEARANCE	15	DAY	1800.00	27,000
				-
				-
				-
				-
EXCAVATION OF 9000 CY OF DEBRIS				
BACKHOE & OPERATOR	12	DAY	1460.00	17,520
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & DRIVER (12 EA)	144	DAY	770.00	110,880
				-
				-
TOTAL THIS PAGE				\$ 222,928

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE SA 12

=====

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 222,928
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT ROLLER & OPERATOR	12	DAY	1570.00	18,840
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	11700	CY	10.00	117,000
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	15	DAY	1570.00	23,550
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
WETLANDS RESTORATION	0.1	AC	50000.00	5,000
REMOVE ACCESS ROAD				-
BACKHOE & OPERATOR	1	DAY	1460.00	1,460
DUMP TRUCK & DRIVER (2 EA)	2	DAY	770.00	1,540
LABORER (2 EA)	16	HR	33.50	536
UNDEVELOPED DESIGN DETAILS ~25%				97,947
TOTAL SA 12				\$ 490,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====

EXCAVATE AND CONSOLIDATE SA 13

=====

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	6	EA	385.00	\$ 2,310
BACKHOE	2	EA	730.00	1,460
ROLLER	2	EA	785.00	1,570
OFFICE TRAILER	1.5	MON	150.00	225
STORAGE TRAILER	1.5	MON	100.00	150
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	12	WK	25.00	300
WATER COOLER - 2 EA	12	WK	25.00	300
WATER	60	DAY	15.00	900
TELEPHONE SERVICE	1.5	MON	500.00	750
ELECTRICITY	1.5	MON	250.00	375
PICK-UP (2 EA)	3	MON	1000.00	3,000
				-
SITE SUPERINTENDANT (1.5 MON * 210 HR/MON)	315	MNHR	65.00	20,475
FOREMEN (1.5 MON * 210 HR/MON)	315	MNHR	55.00	17,325
CLERK/TYPIST (1.5 MON * 168 HR/MON)	252	MNHR	25.00	6,300
				-
ACCESS ROAD - 200 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	450	SY	1.00	450
CLEAR TREES	0.5	AC	6900.00	3,450
				-
EROSION CONTROL	300	LF	5.00	1,500
				-
UXO CLEARANCE	15	DAY	1800.00	27,000
				-
EXCAVATION OF 10000 CY OF DEBRIS				
BACKHOE & OPERATOR	13	DAY	1460.00	18,980
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & OPERATOR (10 EA)	130	DAY	770.00	100,100
				-
REMOVE ACCESS ROAD				
BACKHOE & OPERATOR	1	DAY	1460.00	1,460
DUMP TRUCK & DRIVER (2 EA)	2	DAY	770.00	1,540
LABORER (2 EA)	16	HR	33.50	536
				-

TOTAL THIS PAGE

\$ 214,229

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE SA 13

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 214,229
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT ROLLER & OPERATOR	20	DAY	1570.00	31,400
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	13000	CY	10.00	130,000
SITE RESTORATION BACKFILL, GRADE, COMPACT	16	DAY	1570.00	25,120
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
UNDEVELOPED DESIGN DETAILS ~25%				100,052
TOTAL SA 13				\$ 502,000

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

EXCAVATE AND CONSOLIDATE AOC 40				
SITE PREPARATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
ACCESS ROAD - 600 LF (SEDIMENT REMOVAL AREA I)				
CLEAR & GRUB LIGHT VEGETATION	0.3	AC	4300.00	\$ 1,290
GRADE - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	450	CY	10.00	4,500
SPREAD & COMPACT	0.5	DAY	1570.00	785
FILTER FABRIC	1350	SY	1.00	1,350
PARKING AREA				
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
SEDIMENT DEWATERING PAD				
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
LINER	10000	SF	1.00	10,000
SUMP & SUMP PUMP	1	LS	2500.00	2,500
DECON AREA - 10'x20'				
	3	EA	5000.00	15,000
				-
				-
				-
				-
				-
				-
WORK PLATFORM (SEDIMENT REMOVAL AREA II)				
GRADE - DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
FILTER FABRIC	450	SY	1.00	450
				-
				-
				-
				-
				-
				-
TOTAL SITE PREPARATION			\$	52,568

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Page 13

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

EXCAVATE AND CONSOLIDATE AOC 40 SEDIMENT REMOVAL AND DISPOSAL DESCRIPTION					QTY	UNIT	UNIT COST	TOTAL
CONSTRUCT SILT FENCE AROUND CONTAMINATED AREAS					650	LF	5.00	\$ 3,250
EXCAVATE WITH CLAMSHELL 1200 CY SEDIMENTS + 600 CY ACCESS ROADS/WORK PLATFORMS					19	DAY	1280.00	24,320
HAUL SEDIMENTS TO DEWATERING PAD (2 EA DUMP TRUCK & DRIVER)					38	DAY	770.00	29,260
LOAD DRY SEDIMENTS FOR TRANSPORTATION TO DISPOSAL AREA (FRONT END LOADER & OPERATOR)					10	DAY	825.00	8,250
LABORERS - 2 EA FOR 25 DAYS					400	MNHR	33.50	13,400
TCLP TESTING					2	SMPL	1500.00	3,000
ON-SITE STABILIZATION OF SEDIMENTS WITH SAND					400	CY	15.00	6,000
TRANSPORTATION AND DISPOSAL AT CONSOLIDATION LANDFILL (3 EA DUMP TRUCK & DRIVER)					30	DAY	770.00	23,100
TRANSPORTATION OF WATER					140000	GAL	INCL WITH DISPOSAL	
TREATMENT OF DEWATERING WATER					1	LS	21800.00	21,800
PUMP WATER FROM DEWATERING PAD TO PONDS					12	DAY	50.00	600
TOTAL SEDIMENT REMOVAL AND DISPOSAL								\$ 132,980

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

[illegible]

JOB # 8712-04

DATE 24-Jan-97

EXCAVATE AND CONSOLIDATE AOC 40				
EXCAVATION AND BACKFILL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
CLEAR & GRUB SITE	4	AC	4300.00	\$ 17,200
EROSION CONTROL	500	LF	5.00	2,500
SUMP PUMP & HOSES	6	MON	2500.00	15,000
UXO CLEARANCE	138	DAY	1800.00	248,400
EXCAVATION OF 110000 CY OF DEBRIS				-
BACKHOE & OPERATOR	138	DAY	1460.00	201,480
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & DRIVER (8 EA)	1100	DAY	770.00	847,000
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (2 EA)	276	DAY	1570.00	433,320
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	18710	CY	10.00	187,100
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	24	DAY	1570.00	37,680
FERTILIZE, SEED, MULCH	19360	SY	0.50	9,680
WETLANDS RESTORATION	4	AC	50000.00	200,000
MONITORING WELLS, 4" DIA x 30' DP	2	EA	2400.00	4,800
GUIDE RAIL ALONG ROAD	1000	LF	12.50	12,500
				-
				-
				-
				-
				-
				-
				-
				-
				-
TOTAL EXCAVATION AND BACKFILL				\$ 2,216,660

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
EXCAVATE AND CONSOLIDATE
AOC 9, 40, 41, and SA 6, 12, 13; AND
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 40

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION				\$ 52,568
TOTAL MOBILIZATION				-
TOTAL SEDIMENT REMOVAL AND DISPOSAL				282,810
TOTAL DRUM REMOVAL AND DISPOSAL				-
TOTAL EXCAVATION AND BACKFILL				132,980
				-
				11,298
				-
				2,216,660
				-
UNDEVELOPED DESIGN DETAILS ~25%				673,685
TOTAL AOC 40				\$ 3,370,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE AOC 41

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
BACKHOE TO AOC 41	2	EA	730.00	\$ 1,460
DOZER & ROLLER TO AOC 41	2	EA	660.00	1,320
FOREMAN	100	HR	55.00	5,500
ACCESS ROAD - 350 LF x 20' WIDE				-
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	800	SY	5.00	4,000
GEOFABRIC	800	SY	2.00	1,600
CLEAR TREES	0.5	AC	6000.00	3,000
EROSION CONTROL	150	LF	5.00	750
UXO CLEARANCE	3	DAY	1800.00	5,400
EXCAVATION OF 1500 CY OF DEBRIS				-
BACKHOE & OPERATOR	2	DAY	1460.00	2,920
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & DRIVER (10 EA)	20	DAY	770.00	15,400
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR	3	DAY	1570.00	4,710
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% FACTOR)	1950	CY	10.00	19,500
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	3	DAY	1570.00	4,710
FERTILIZE, SEED, MULCH	700	SY	0.50	350
REMOVE ACCESS ROAD (~110 LF)				-
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
DUMP TRUCK & DRIVER (2 EA)	2	DAY	770.00	1,540
LABORER (2 EA)	16	HR	33.50	536
UNDEVELOPED DESIGN DETAILS ~25%				18,599
TOTAL AOC 41				\$ 93,000

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

CONSOLIDATION LANDFILL CONSTRUCTION

[illegible]

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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CONSOLIDATION LANDFILL CONSTRUCTION				
LINER CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

EXCAVATE LANDFILL BASE & BY-PASS DITCH				
BACK HOE & OPERATOR (2 EA)	126	DAY	1460.00	\$ 183,960
HAUL TO ON-SITE STOCKPILE (23250 CY)				
DUMP TRUCK & DRIVER (3 EA)	45	DAY	770.00	34,650
HAUL TO AOC-9 & STOCKPILE (88750 CY)				
DUMP TRUCK & DRIVER (16 EA)	880	DAY	770.00	677,600
DOZER & OPERATOR	55	DAY	1760.00	96,800
				-
CLAY	31850	CY	10.00	318,500
GEOMEMBRANE	330000	SF	0.65	214,500
FILTER FABRIC	330000	SF	0.10	33,000
10-2 SAND DRAINAGE LAYER	15925	CY	12.00	191,100
10-3 SAND DRAINAGE LAYER	15925	CY	17.00	270,725
ROLLER & OPERATOR	80	DAY	1570.00	125,600
				-
				-
DRAINAGE PIPING				-
6" DIA PERF PVC PIPE	2500	LF	6.00	15,000
12" DIA SOLID WALL PVC PIPE	1600	LF	15.00	24,000
6"x12" PVC WYE	5	EA	500.00	2,500
				-
LEACHATE PUMPING CHAMBER				-
5' DIA PRECAST MANHOLE	10	VLF	250.00	2,500
FRAME, COVER, ETC.	1	LS	300.00	300
CONCRETE FILL PAD, SUMP, ELECTRICAL	1	LS	35000.00	35,000
CONTROLS, ALARM, FILL PIPING, BOLLARDS				-
HAUL LEACHATE TO BASE TREATMENT PLANT	2600	HR	100.00	260,000
10 HR/DAY * 5 DAY/WK * 52 WK				-
				-
				-
				-
NOTE: ALL LINER SOIL MATERIAL QUANTITIES				-
INCLUDE A 30% SWELL FACTOR				-
				-
TOTAL LINER CONSTRUCTION				\$ 2,485,735

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

=====				
ANNUAL O&M COSTS				
LIMITED REMOVAL AT AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS TWICE PER YEAR FOR TWO YEARS FOR SITE RESTORATION				
DUMP TRUCK & DRIVER	2	DAY	770.00	\$ 1,540
MATERIALS	1	LS	500.00	500
LABORER - 2 EA	32	MNHR	33.50	1,072

UNDEVELOPED DESIGN DETAILS ~25%

888

TOTAL ANNUAL O&M COSTS

\$ 4,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

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=====				
ANNUAL O&M COSTS				
CONSOLIDATION LANDFILL				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS OCCURRING OVER THIRTY YEARS FOR CONSOLIDATION LANDFILL				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	10000.00	\$ 1,810
				-
ENVIRONMENTAL MONITORING				-
GROUNDWATER, 4 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	8	SMPL	940.00	7,520
				-
LANDFILL COVER MAINTENANCE				-
INSPECTION - 2 DAY @ 2 MEN/DAY	32	MNHR	75.00	2,400
GENERAL REPAIR				-
DUMP TRUCK & DRIVER	1	DAY	770.00	770
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
MOWING	2	EVENT	1000.00	2,000
				-
BI-ANNUAL REPORT TO DEP - ANNUALIZED	0.4878	LS	2500.00	1,220
AYER WWTP USER FEE	600	CCF	2.00	1,200
UNDEVELOPED DESIGN DETAILS ~25%				4,220

TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 23,000
=====				

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11
 EXCAVATE AND CONSOLIDATE
 AOC 9, 40, 41, and SA 6, 12, 13; AND
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

ANNUAL O&M COSTS AOC 40				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURING OVER FIVE YEARS FOR CSB LANDFILL				
SEDIMENT, 2 SAMPLES AT 2 LOCATIONS, ONE TIME ONLY AT YEAR 5				
METALS - ANNUALIZED	0.7239	SMPL	625.00	\$ 452
				-
GROUNDWATER MONITORING, 2 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	4	SMPL	1020.00	4,080
				-
SAMPLE COLLECTION (INCLUDES WELL	2	LS	2500.00	5,000
PURGE, SAMPLE COLLECTION, AND SHIPMENT)				-
				-
WETLANDS RESTORATION MONITORING				-
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	2,400
				-
BIO MONITORING, BI-ANNUALLY	0.4878	LS	15000.00	7,317
				-
FIVE YEAR EDUCATION PROGRAM ONCE	0.1810	LS	2500.00	452
PUBLIC MEETING - ANNUALIZED				-
				-
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	20000.00	3,619
				-
UNDEVELOPED DESIGN DETAILS ~25%				5,679
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				\$ 29,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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COST SUMMARY TABLE

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
DIRECT COSTS				
SA 6				\$ 64,000
AOC 9				3,835,000
AOC 11				1,571,000
SA 12				490,000
SA 13				502,000
AOC 40				3,370,000
AOC 41				93,000
CONSOLIDATION LANDFILL CONSTRUCTION				5,240,000
TOTAL DIRECT COSTS				\$15,165,000
INDIRECT COSTS				
HEALTH AND SAFETY			5.00%	\$ 758,000
LEGAL, ADMIN, PERMITTING			5.00%	758,000
ENGINEERING			10.00%	1,517,000
SERVICES DURING CONSTRUCTION			10.00%	1,517,000
TOTAL INDIRECT COSTS				\$ 4,550,000
TOTAL CAPITAL (DIRECT + INDIRECT) COST				\$19,715,000
OPERATING AND MAINTENANCE COSTS				
TOTAL ANNUAL O&M COSTS FOR CONSOLIDATION LANDFILL				\$ 23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YEARS				29,000
TOTAL PRESENT WORTH OF OPERATING AND MAINTENANCE COSTS				\$ 480,000
TOTAL COSTS				\$20,195,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE SA 6				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

MOB/DEMOB				
BACKHOE TO SA 6	2	EA	730.00	\$ 1,460
DOZER & ROLLER TO SA 6	2	EA	660.00	1,320
DUMP TRUCK	6	EA	385.00	2,310
ACCESS ROAD - 675 LF x 15' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	1	DAY	1760.00	1,760
GRAVEL - 12" THICK	1125	SY	5.00	5,625
GEOFABRIC	1125	SY	2.00	2,250
CLEAR TREES FROM SITE	0.25	AC	6000.00	1,500
ARCHAEOLOGICAL SURVEY OF LANDFILL				
PROJECT MANAGER	1	DAY	405.00	405
PRINCIPAL INVESTIGATOR	1	DAY	365.00	365
PROJECT ARCHAEOLOGIST	7	DAY	265.00	1,855
ASSISTANT ARCHAEOLOGIST	6	DAY	185.00	1,110
WORK PROCESSOR	1	DAY	175.00	175
ODCs	1	LS	100.00	100
MILAGE	1000	MILE	0.25	250
PER DIEM	5	DAY	60.00	300
UXO CLEARANCE	2	DAY	1800.00	3,600
FOREMAN	100	HR	55.00	5,500
EXCAVATION & HAULING				
BACKHOE & OPERATOR	2	DAY	1460.00	2,920
LABORER	16	HR	33.50	536
DUMP TRUCK & DRIVER - 3 EA	6	DAY	770.00	4,620
SPREAD & COMPACT AT ON-SITE CONSOLIDATION LANDFILL (INLC 50% SWELL FACTOR)				
ROLLER & OPERATOR	2	DAY	1570.00	3,140
REMOVE ACCESS ROAD (~70 LF)				
BACKHOE & OPERATOR	0.5	DAY	1460.00	730
DUMP TRUCK & DRIVER	0.5	DAY	770.00	385
LABORER	4	HR	33.50	134

TOTAL THIS PAGE				\$ 42,350

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE SA 6				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 42,350
BACKFILL PURCHASED FORM OFF-SITE (INCLUDING 30% SWELL FACTOR)	650	CY	10.00	6,500
				-
				-
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	1	DAY	1570.00	1,570
FERTILIZE, SEED, MULCH	1200	SY	0.50	600
				-
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				12,980
TOTAL SA 6				\$ 64,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE AOC 9				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	32	EA	385.00	\$ 12,320
BACKHOE	4	EA	730.00	2,920
ROLLER	8	EA	785.00	6,280
OFFICE TRAILER	5	MON	150.00	750
STORAGE TRAILER	5	MON	100.00	500
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	44	WK	25.00	1,100
WATER COOLER - 2 EA	44	WK	25.00	1,100
WATER	220	DAY	15.00	3,300
TELEPHONE SERVICE	5	MON	500.00	2,500
ELECTRICITY	5	MON	250.00	1,250
PICK-UP (2 EA)	10	MON	1000.00	10,000
				-
PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	2500.00	2,500
				-
SITE SUPERINTENDANT (5 MON * 210 HR/MON)	1050	MNHR	65.00	68,250
FOREMEN (5 MON * 210 HR/MON)	1050	MNHR	55.00	57,750
CLERK/TYPIST (5 MON * 168 HR/MON)	840	MNHR	25.00	21,000
				-
CLEAR TREES	2.5	AC	6900.00	17,250
				-
EROSION CONTROL	700	LF	5.00	3,500
				-
UXO CLEARANCE	70	DAY	1800.00	126,000
				-
				-
				-
EXCAVATION OF 112000 CY OF DEBRIS				-
BACKHOE & OPERATOR (2 EA)	140	DAY	1460.00	204,400
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				-
DUMP TRUCK & OPERATOR (16 EA)	1120	DAY	770.00	862,400
				-
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (4 EA)	280	DAY	1570.00	439,600
				-
				-
				-
TOTAL THIS PAGE				\$ 1,845,670

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 9

=====

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 1,845,670
BACKFILL (112,000 * 1.3 = 145,600 CY REQUIRED)				
AVAILABLE FROM CONSOLIDATION LANDFILL EXCAVATION	88750	CY	0.00	0
LOAD STOCKPILED BACKFILL	110	DAY	825.00	90,750
HAUL & DUMP	330	DAY	770.00	254,100
PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	56850	CY	10.00	568,500
SITE RESTORATION				
BACKFILL, GRADE, COMPACT (2 EA)	182	DAY	1570.00	285,740
FERTILIZE, SEED, MULCH	36300	SY	0.50	18,150
WETLAND RESTORATION	0.1	AC	50000.00	5,000
UNDEVELOPED DESIGN DETAILS ~25%				767,090
TOTAL AOC 9				\$ 3,835,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

MOB/DEMOB (IN AND OUT)				
DUMP TRUCKS	6	EA	385.00	\$ 2,310
BACKHOE	2	EA	730.00	1,460
ROLLER	4	EA	785.00	3,140
OFFICE TRAILER	3	MON	150.00	450
STORAGE TRAILER	3	MON	100.00	300
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	24	WK	25.00	600
WATER COOLER - 2 EA	24	WK	25.00	600
WATER	120	DAY	15.00	1,800
TELEPHONE SERVICE	3	MON	500.00	1,500
ELECTRICITY	3	MON	250.00	750
PICK-UP (2 EA)	3	MON	1000.00	3,000
				-
SITE SUPERINTENDANT (3 MON * 210 HR/MON)	630	MNHR	65.00	40,950
FOREMEN (3 MON * 210 HR/MON)	630	MNHR	55.00	34,650
CLERK/TYPIST (3 MON * 168 HR/MON)	504	MNHR	25.00	12,600
				-
ACCESS ROAD - 850 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	2	DAY	1760.00	3,520
GRAVEL - 12" THICK	650	CY	10.00	6,500
SPREAD & COMPACT	1	DAY	1570.00	1,570
GEOFABRIC	1900	SY	1.00	1,900
CLEAR TREES	0.5	AC	4300.00	2,150
				-
UXO CLEARANCE	45	DAY	1800.00	81,000
				-
				-
				-
EROSION CONTROL	900	LF	5.00	4,500
				-
EXCAVATION OF 35000 CY OF DEBRIS				
BACKHOE & OPERATOR	45	DAY	1460.00	65,700
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & DRIVER	360	DAY	770.00	277,200
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				-
ROLLER & OPERATOR (2 EA)	90	DAY	1570.00	141,300
				-
TOTAL THIS PAGE				\$ 690,450

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE AOC 11				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

TOTAL PREVIOUS PAGE				\$ 690,450
REMOVE ACCESS ROAD				-
FRONT END LOADER & OPERATOR	2	DAY	825.00	1,650
DUMP TRUCK & DRIVER (2 EA)	4	DAY	785.00	3,140
LABORER (2 EA)	32	HR	33.50	1,072
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	45500	CY	10.00	455,000
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT (2 EA)	60	DAY	1570.00	94,200
FERTILIZE, SEED, MULCH	12100	SY	0.50	6,050
WETLAND RESTORATION	0.1	AC	50000.00	5,000
UNDEVELOPED DESIGN DETAILS ~25%				314,438
TOTAL AOC 11				\$ 1,571,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

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EXCAVATE AND CONSOLIDATE SA 12

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	10	EA	385.00	\$ 3,850
BACKHOE	2	EA	730.00	1,460
ROLLER	2	EA	785.00	1,570
OFFICE TRAILER	1.5	MON	150.00	225
STORAGE TRAILER	1.5	MON	100.00	150
SET UP TRAILER	2	EA	500.00	1,000
TOILET - 2 EA	12	WK	25.00	300
WATER COOLER - 2 EA	12	WK	25.00	300
WATER	60	DAY	15.00	900
TELEPHONE SERVICE	1.5	MON	500.00	750
ELECTRICITY	1.5	MON	250.00	375
PICK-UP (2 EA)	3	MON	1000.00	3,000
SITE SUPERINTENDANT (1.5 MON * 210 HR/MON)	315	MNHR	65.00	20,475
FOREMEN (1.5 MON * 210 HR/MON)	315	MNHR	55.00	17,325
CLERK/TYPIST (1.5 MON * 168 HR/MON)	252	MNHR	25.00	6,300
ACCESS ROAD - 300 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	250	CY	10.00	2,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	700	SY	1.00	700
CLEAR TREES	0.5	AC	6900.00	3,450
EROSION CONTROL	325	LF	5.00	1,625
UXO CLEARANCE	15	DAY	1800.00	27,000
EXCAVATION OF 9000 CY OF DEBRIS				
BACKHOE & OPERATOR	12	DAY	1460.00	17,520
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & DRIVER (12 EA)	144	DAY	770.00	110,880
TOTAL THIS PAGE				\$ 222,928

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
ALL SEVEN DISPOSAL AREAS

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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EXCAVATE AND CONSOLIDATE SA 12

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DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 222,928
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT ROLLER & OPERATOR	12	DAY	1570.00	18,840
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	11700	CY	10.00	117,000
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	15	DAY	1570.00	23,550
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
WETLANDS RESTORATION	0.1	AC	50000.00	5,000
REMOVE ACCESS ROAD				-
BACKHOE & OPERATOR	1	DAY	1460.00	1,460
DUMP TRUCK & DRIVER (2 EA)	2	DAY	770.00	1,540
LABORER (2 EA)	16	HR	33.50	536
UNDEVELOPED DESIGN DETAILS ~25%				97,947
TOTAL SA 12				\$ 490,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

=====

EXCAVATE AND CONSOLIDATE SA 13

=====

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
DUMP TRUCKS	6	EA	385.00	\$ 2,310
BACKHOE	2	EA	730.00	1,460
ROLLER	2	EA	785.00	1,570
OFFICE TRAILER	1.5	MON	150.00	225
STORAGE TRAILER	1.5	MON	100.00	150
SET UP TRAILER	2	EA	500.00	1,000
				-
TOILET - 2 EA	12	WK	25.00	300
WATER COOLER - 2 EA	12	WK	25.00	300
WATER	60	DAY	15.00	900
TELEPHONE SERVICE	1.5	MON	500.00	750
ELECTRICITY	1.5	MON	250.00	375
PICK-UP (2 EA)	3	MON	1000.00	3,000
				-
SITE SUPERINTENDANT (1.5 MON * 210 HR/MON)	315	MNHR	65.00	20,475
FOREMEN (1.5 MON * 210 HR/MON)	315	MNHR	55.00	17,325
CLERK/TYPIST (1.5 MON * 168 HR/MON)	252	MNHR	25.00	6,300
				-
ACCESS ROAD - 200 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
GEOFABRIC	450	SY	1.00	450
CLEAR TREES	0.5	AC	6900.00	3,450
				-
EROSION CONTROL	300	LF	5.00	1,500
				-
UXO CLEARANCE	15	DAY	1800.00	27,000
				-
EXCAVATION OF 10000 CY OF DEBRIS				
BACKHOE & OPERATOR	13	DAY	1460.00	18,980
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & OPERATOR (10 EA)	130	DAY	770.00	100,100
				-
REMOVE ACCESS ROAD				
BACKHOE & OPERATOR	1	DAY	1460.00	1,460
DUMP TRUCK & DRIVER (2 EA)	2	DAY	770.00	1,540
LABORER (2 EA)	16	HR	33.50	536
				-
TOTAL THIS PAGE				\$ 214,229

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE SA 13				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL PREVIOUS PAGE				\$ 214,229
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT ROLLER & OPERATOR	20	DAY	1570.00	31,400
BACKFILL PURCHASED FROM OFF-SITE (INCLUDING 30% SWELL FACTOR)	13000	CY	10.00	130,000
SITE RESTORATION				-
BACKFILL, GRADE, COMPACT	16	DAY	1570.00	25,120
FERTILIZE, SEED, MULCH	2400	SY	0.50	1,200
				-
				-
UNDEVELOPED DESIGN DETAILS ~25%				100,052
TOTAL SA 13				\$ 502,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE AOC 40				
SITE PREPARATION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

ACCESS ROAD - 600 LF (SEDIMENT REMOVAL AREA I)				
CLEAR & GRUB LIGHT VEGETATION	0.3	AC	4300.00	\$ 1,290
GRADE - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	450	CY	10.00	4,500
SPREAD & COMPACT	0.5	DAY	1570.00	785
FILTER FABRIC	1350	SY	1.00	1,350
PARKING AREA				-
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
SEDIMENT DEWATERING PAD				-
CLEAR & GRUB LIGHT VEGETATION	0.25	AC	4300.00	1,075
GRADE - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	400	CY	10.00	4,000
SPREAD & COMPACT	0.5	DAY	1570.00	785
LINER	10000	SF	1.00	10,000
SUMP & SUMP PUMP	1	LS	2500.00	2,500
DECON AREA - 10'x20'	3	EA	5000.00	15,000
				-
				-
				-
				-
				-
				-
				-
WORK PLATFORM (SEDIMENT REMOVAL AREA II)				-
GRADE - DOZER & OPERATOR	0.25	DAY	1760.00	440
GRAVEL - 12" THICK	150	CY	10.00	1,500
SPREAD & COMPACT	0.25	DAY	1570.00	393
FILTER FABRIC	450	SY	1.00	450
				-
				-
				-
				-
				-
				-
				-
TOTAL SITE PREPARATION				\$ 52,568

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

EXCAVATE AND CONSOLIDATE AOC 40					
	MOBILIZATION DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
EQUIPMENT (IN and OUT)					
	FRAC TANK	8	EA	250.00	\$ 2,000
	DEWATERING PUMP & HOSE	4	EA	100.00	400
	DUMP TRUCKS	16	EA	385.00	6,160
	BACKHOE	2	EA	730.00	1,460
	ROLLER	4	EA	785.00	3,140
	CLAM SHELL	2	EA	640.00	1,280
	OFFICE TRAILER	7	MON	150.00	1,050
	STORAGE TRAILER	7	MON	150.00	1,050
	TRAILER DELIVERY, SET-UP, REMOVAL	2	EA	300.00	600
	TOILET - 2 EA	60	WK	25.00	1,500
	WATER COOLER - 2 EA	60	WK	25.00	1,500
	WATER	300	DAY	15.00	4,500
	TELEPHONE SERVICE	7	MON	500.00	3,500
	ELECTRICITY	7	MON	250.00	1,750
	PICK-UP (2 EA)	14	MON	1000.00	14,000
	OFFICE EQUIPMENT	7	MON	1000.00	7,000
	PUMPS, TOOLS, MINOR EQUIPMENT	1	LS	5000.00	5,000
	LABORER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	33.50	5,360
	CARPENTER (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	48.00	7,680
	ELECTRICIAN (2 MEN*10 DAY/MAN*8 HR/DAY)	160	MNHR	50.50	8,080
	SITE SUPERINTENDANT (7 MON*210HR/MON)	1470	MNHR	65.00	95,550
	FOREMAN (7 MON*210HR/MON)	1470	MNHR	55.00	80,850
	CLERK/TYPIST (7 MON*168HR/MON)	1176	MNHR	25.00	29,400
TOTAL MOBILIZATION					\$ 282,810

JOB # 8712-04

DATE · 24-Jan-97

ESTIMATOR: P. R. MARTIN

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JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

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JOB # 8712-04

DATE 24-Jan-97

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PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
ALL SEVEN DISPOSAL AREAS

JOB # 8712-04

LOCATION: DEVENS, MASSACHUSETTS

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

=====

EXCAVATE AND CONSOLIDATE AOC 40

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
TOTAL SITE PREPARATION				\$ 52,568
TOTAL MOBILIZATION				282,810
TOTAL SEDIMENT REMOVAL AND DISPOSAL				132,980
TOTAL DRUM REMOVAL AND DISPOSAL				11,298
TOTAL EXCAVATION AND BACKFILL				2,216,660
UNDEVELOPED DESIGN DETAILS ~25%				673,685
TOTAL AOC 40				\$ 3,370,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

=====				
EXCAVATE AND CONSOLIDATE AOC 41				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
MOB/DEMOB (IN and OUT)				
BACKHOE TO AOC 41	2	EA	730.00	\$ 1,460
DOZER & ROLLER TO AOC 41	2	EA	660.00	1,320
				-
ACCESS ROAD - 350 LF x 20' WIDE				
GRADE ROAD BED - DOZER & OPERATOR	0.5	DAY	1760.00	880
GRAVEL - 12" THICK	800	SY	5.00	4,000
GEOFABRIC	800	SY	2.00	1,600
				-
CLEAR TREES	0.5	AC	6000.00	3,000
				-
EROSION CONTROL	150	LF	5.00	750
				-
FOREMAN	100	HR	55.00	5,500
				-
UXO CLEARANCE	3	DAY	1800.00	5,400
				-
EXCAVATION OF 1500 CY OF DEBRIS				
BACKHOE & OPERATOR	2	DAY	1460.00	2,920
TRANSPORT TO ON-SITE CONSOLIDATION LANDFILL (50% SWELL FACTOR INCLUDED)				
DUMP TRUCK & DRIVER (10 EA)	20	DAY	770.00	15,400
				-
SPREAD OVER ON-SITE CONSOLIDATION LANDFILL & COMPACT				
ROLLER & OPERATOR	3	DAY	1570.00	4,710
				-
BACKFILL PURCHASED FROM OFF-SITE				
(INCLUDING 30% FACTOR)	1950	CY	10.00	19,500
				-
SITE RESTORATION				
BACKFILL, GRADE, COMPACT	3	DAY	1570.00	4,710
FERTILIZE, SEED, MULCH	700	SY	0.50	350
				-
REMOVE ACCESS ROAD (~110 LF)				
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
DUMP TRUCK & DRIVER (2 EA)	2	DAY	770.00	1,540
LABORER (2 EA)	16	HR	33.50	536
				-
UNDEVELOPED DESIGN DETAILS ~25%				18,599
TOTAL AOC 41				\$ 93,000
=====				

JOB # 8712-04

DATE 24-Jan-97

ESTIMATOR: P. R. MARTIN

[illegible]

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
CONSOLIDATION LANDFILL CONSTRUCTION				
LINER CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

EXCAVATE LANDFILL BASE & BY-PASS DITCH				
BACK HOE & OPERATOR (2 EA)	126	DAY	1460.00	\$ 183,960
HAUL TO ON-SITE STOCKPILE (23250 CY)				
DUMP TRUCK & DRIVER (3 EA)	45	DAY	770.00	34,650
HAUL TO AOC-9 & STOCKPILE (88750 CY)				
DUMP TRUCK & DRIVER (16 EA)	880	DAY	770.00	677,600
DOZER & OPERATOR	55	DAY	1760.00	96,800
				-
CLAY	31850	CY	10.00	318,500
GEOMEMBRANE	330000	SF	0.65	214,500
FILTER FABRIC	330000	SF	0.10	33,000
10-2 SAND DRAINAGE LAYER	15925	CY	12.00	191,100
10-3 SAND DRAINAGE LAYER	15925	CY	17.00	270,725
ROLLER & OPERATOR	80	DAY	1570.00	125,600
				-
DRAINAGE PIPING				-
6" DIA PERF PVC PIPE	2500	LF	6.00	15,000
12" DIA SOLID WALL PVC PIPE	1600	LF	15.00	24,000
6"x12" PVC WYE	5	EA	500.00	2,500
				-
LEACHATE PUMPING CHAMBER				-
5' DIA PRECAST MANHOLE	10	VLF	250.00	2,500
FRAME, COVER, ETC.	1	LS	300.00	300
CONCRETE FILL PAD, SUMP, ELECTRICAL	1	LS	35000.00	35,000
CONTROLS, ALARM, FILL PIPING, BOLLARDS				-
HAUL LEACHATE TO BASE TREATMENT PLANT	2600	HR	100.00	260,000
10 HR/DAY * 5 DAY/WK * 52 WK				-
				-
NOTE: ALL LINER SOIL MATERIAL QUANTITIES				-
INCLUDE A 30% SWELL FACTOR				-
				-
TOTAL LINER CONSTRUCTION				\$ 2,485,735

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

[illegible]

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
ALL SEVEN DISPOSAL AREAS
LOCATION: DEVENS, MASSACHUSETTS
ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
ESTIMATOR: P. R. MARTIN

JOB # 8712-04

DATE 24-Jan-97

=====				
CONSOLIDATION LANDFILL CONSTRUCTION				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

TOTAL MOBILIZATION				\$ 357,910
TOTAL SITE PREPARATION				115,500
TOTAL LINER CONSTRUCTION				2,485,735
TOTAL FINAL COVER CONSTRUCTION				1,232,875

UNDEVELOPED DESIGN DETAILS ~25%	1,047,980
TOTAL CONSOLIDATION LANDFILL CONSTRUCTION	\$ 5,240,000

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS
 ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.
 ESTIMATOR: P. R. MARTIN

JOB # 8712-04
 DATE 24-Jan-97

=====				
ANNUAL O&M COSTS				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL

O&M COSTS OCCURRING OVER THIRTY YEARS FOR CONSOLIDATION LANDFILL				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	10000.00	\$ 1,810
				-
ENVIRONMENTAL MONITORING				-
GROUNDWATER, 4 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	8	SMPL	940.00	7,520
				-
LANDFILL COVER MAINTENANCE				-
INSPECTION - 2 DAY @ 2 MEN/DAY	32	MNHR	75.00	2,400
GENERAL REPAIR				-
DUMP TRUCK & DRIVER	1	DAY	770.00	770
FRONT END LOADER & OPERATOR	1	DAY	825.00	825
LABORER - 2 EA	16	MNHR	33.50	536
MATERIALS	1	LS	500.00	500
MOWING	2	EVENT	1000.00	2,000
				-
BI-ANNUAL REPORT TO DEP - ANNUALIZED	0.4878	LS	2500.00	1,220
AYER WWTP USER FEE	600	CCF	2.00	1,200
UNDEVELOPED DESIGN DETAILS ~25%				4,220

TOTAL ANNUAL O&M COSTS FOR 30 YEAR ACTIVITIES				\$ 23,000

**HYDROGEOLOGICAL ASSESSMENT AT
SHEPLEY'S HILL LANDFILL AREA**

ABB Environmental Services, Inc.

PHYSICAL CHARACTERISTICS

Fort Devens is located in the towns of Ayer and Shirley (Middlesex County) and Harvard and Lancaster (Worcester County), approximately 35 miles northwest of Boston, Massachusetts. It lies within the Ayer, Shirley, and Clinton map quadrangles (7½-minute series). The installation occupies approximately 9,260 acres and is divided into the North Post, the Main Post, and the South Post (Figure E-1).

More than 6,000 acres at Fort Devens are used for training and military maneuvers, and more than 3,000 acres are developed for housing, buildings, and other facilities; the installation has been reported as the largest undeveloped land holding under a single owner in north-central Massachusetts (USFWS, 1992).

The South Post is located south of Massachusetts Route 2 and is largely undeveloped. The Main Post and North Post primarily contain developed lands, including recreational areas (e.g., a golf course and Mirror Lake), training areas, and an airfield. Shepley's Hill Landfill is located on the main post.

Currently, the mission at Fort Devens is to command and train its assigned duty units; operate the South Boston Support Activity in Boston; the Sudbury Training Annex and the Hingham USAR Annex; and to support the 10th Special Forces Group (A), the U.S. Army Reserves; Massachusetts Army National Guard; and ROTC Training Programs. No major industrial operations occur at Fort Devens, although several small-scale industrial operations are performed under (1) the Directorate of Plans, Training, and Security; (2) the Directorate of Logistics; and (3) the Directorate of Engineering and Housing. The major waste-producing operations by these groups are photographic processing and maintenance of vehicles, aircraft, and small engines. Past artillery fire, mortar fire, and waste explosive disposal at Fort Devens are potential sources for explosives contamination (USAEC, 1993).

Under Public Law 101-510, the Base Closure and Realignment Act (BRAC) of 1990, Fort Devens has been identified for closure by July 1997, and 4,600 acres are to be retained to establish a Reserve Component enclave and regional training center.

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APPENDIX E

As part of the base closure requirements several environmental investigations have been conducted at Fort Devens. Studies conducted at Shepley's Hill Landfill include a Preliminary Assessment as part of the Master Environmental Plan (Biang, et al., 1992), a Remedial Investigation (Ecology and Environment, 1993), a Remedial Investigation Addendum Report (ABB, 1993), a Feasibility Study (ABB, 1994), and a Pre-Remedial Design Investigation (Stone and Webster, 1995). The information collected during these investigations is sufficient to characterize the geologic and hydrogeologic conditions of Shepley's Hill Landfill and therefore further hydrogeologic study as stated in 310 CMR 19.104 does not appear to be warranted.

E.2 PHYSICAL SETTING

E.2.1 Climate

The climate of Fort Devens is typical of the northeastern United States, with long cold winters and short hot summers. Climatological data were reported for Fort Devens by the U.S. Department of the Army (1979), based in part on a 16-year record from Moore Army Airfield (MAAF).

The mean daily minimum temperature in the coldest months (January and February) is 17 degrees Fahrenheit (°F), and the mean daily maximum temperature in the hottest month (July) is 83°F. The average annual temperature is 58°F. There are normally 12 days per year when the temperature reaches or exceeds 90°F and 134 days when it falls to or below freezing.

The average annual rainfall is 39 inches. Mean monthly precipitation varies from a low of 2.3 inches (in June) to a high of 5.5 inches (in September). The average annual snowfall is 65 inches, and snowfall has been recorded in the months of September through May (falling most heavily from December through March).

Monthly precipitation and recharge estimates were calculated as part of the groundwater modeling conducted for the Shepley's Hill Landfill Feasibility Study (ABB, 1994). Daily precipitation data were obtained from the National Climatic Data Center for the period from January 1986 to April 1993 for six cooperative weather stations that surround Fort Devens: Ashburnham, Framingham, Lowell, Natick, Pepperell, and the Worcester Airport. Fort Devens precipitation data were not used as they were not typically collected over a full 24 hour period.

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APPENDIX E

Potential evapotranspiration was calculated using the Blaney-Criddle formula. In any month when average monthly precipitation minus potential evapotranspiration was less than one inch, recharge was assumed to be one inch for the month.

Month	Average Precipitation (in)	Potential Evapotranspiration (in)	Recharg e (in)
Jan	3.79	0.81	2.98
Feb	3.11	0.99	2.12
March	3.95	2.14	1.81
April	3.71	3.55	1.00
May	3.54	5.26	1.00
June	3.6	6.28	1.00
July	3.44	6.84	1.00
Aug	3.68	6.11	1.00
Sept	3.86	4.52	1.00
Oct	3.31	3.14	1.00
Nov	4.15	1.81	2.34
Dec	3.88	1.01	2.87
Total	44.02	42.46	19.12

Wind speed averages 5 miles per hour (mph), ranging from the highest monthly average of 7 mph (March-April) to the lowest monthly average of 4 mph (September).

Average daytime relative humidities range from 71 percent (January) to 91 percent (August), and average nighttime relative humidities range from 46 percent (April) to 60 percent (January).

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APPENDIX E

E.2.2 Physiography

Fort Devens is in a transitional area between the coastal lowland and central upland regions of Massachusetts. All of the landforms are products of glacial erosion and deposition on a crystalline bedrock terrain. Glacial erosion was superimposed on ancient bedrock landforms that were developed by the erosional action of preglacial streams. Generally, what were bedrock hills and ridges before the onset of Pleistocene glaciation were only moderately modified by glacial action, and they remain bedrock hills and ridges today. Similarly, preglacial bedrock valleys are still bedrock valleys. In post-glacial time, streams have locally modified the surficial glacial landforms but generally have not affected bedrock.

The predominant physiographic (and hydrologic) feature in the Fort Devens area is the Nashua River. It forms the eastern installation boundary on the South Post, where its valley varies from a relatively narrow channel (at Still River Gate), to an extensive floodplain with a meandering river course and numerous cutoff meanders (at Oxbow National Wildlife Sanctuary). The Nashua River forms the western boundary of much of the Main Post, and there its valley is deep and comparatively steep-sided with extensive bedrock outcroppings on the eastern bank. The river flows through the North Post in a well-defined channel within a broad forested floodplain.

Terrain at Fort Devens falls generally into three types. The least common is bedrock terrain, where rocks that have been resistant to both glacial and fluvial erosion remain as topographic highs, sometimes thinly veneered by glacial deposits. Shepley's Hill on the Main Post is the most prominent example.

A similar but more common terrain at Fort Devens consists of materials (tills) deposited directly by glaciers as they advanced through the area or as the ice masses wasted (melted). These landforms often conform to the shape of the underlying bedrock surface. They range from areas of comparatively low topographic relief (such as near Lake George Street on the Main Post) to elongated hills (drumlins) whose orientations reflect the direction of glacier movement (such as Whittemore Hill on the South Post).

The third type of terrain was formed by sediment accumulations in glacial-meltwater streams and lakes (glaciofluvial and glaciolacustrine deposits). This is the most common terrain at Fort Devens, comprising most of the North and

South Posts and much of the Main Post. Its form bears little or no relationship to the shape of the underlying bedrock surface. Landforms include extensive flat uplands such as the hills on which MAAF and the wastewater infiltration beds are located on the North Post. Those are large remnants of what was once a continuous surface that was later incised and divided by downcutting of the Nashua River. Another prominent glacial meltwater feature is the area around Cranberry Pond and H-Range on the South Post. This is classic kame-and-kettle topography formed by sand and gravel deposition against and over large isolated ice blocks, followed by melting of the ice and collapse of the sediments. The consistent elevations of the tops of these ice-contact deposits are an indication of the glacial-lake stage with which they are associated. Mirror Lake and Little Mirror Lake on the Main Post occupy another conspicuous kettle.

E.2.3 Soils

Fort Devens lies within Worcester County and Middlesex County in Massachusetts (see Figure E-1). The soils of Worcester County have been mapped by the Soil Conservation Service (SCS) of the U.S. Department of Agriculture (USDA) (USDA, 1985). Mapping of the soils of Middlesex County has not been completed. However, an interim report (USDA, 1991), field sheet #19 (USDA, 1989), and an unpublished general soil map (USDA, undated) are available.

Soil mapping units ("soil series") that occur together in intricate characteristic patterns in given geographic areas are grouped into soil "associations." Soils in the Worcester County portions of Fort Devens consist generally of three associations. Three associations also have been mapped in the Middlesex County portions of Fort Devens. Although the mapped associations are not entirely the same on both sides of the county line, the differences reflect differences in definition and the interim status of Middlesex County mapping. The general distributions of the soil associations are shown in Figure E-2, and descriptions of the soil series in those associations are provided below.

WORCESTER COUNTY (USDA, 1985)

Winooski-Limerick-Saco Association:

Winooski Series. Very deep; moderately well drained; slopes 0 to 3 percent; occurs on floodplains; forms in silty alluvium.

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Limerick Series. Very deep; poorly drained; slopes 0 to 3 percent; occurs on floodplains; forms in silty alluvium.

Saco Series. Very deep; very poorly drained; slopes 0 to 3 percent; occurs on floodplains; derived mainly from schist and gneiss.

Hinckley-Merrimac-Windsor Association:

Hinckley Series. Very deep; excessively drained; slopes 0 to 35 percent; occurs on stream terraces, eskers, kames, and outwash plains.

Merrimac Series. Very deep; excessively drained; slopes 0 to 25 percent; occurs on stream terraces, eskers, kames, and outwash plains.

Windsor Series. Very deep; moderately well drained; slopes 0 to 3 percent; occurs on floodplains.

Paxton-Woodbridge-Canton Association:

Paxton Series. Very deep; well drained; slopes 3 to 35 percent; occurs on glacial till uplands; formed in friable till overlying firm till.

Woodbridge Series. Very deep; moderately well drained; slopes 0 to 15 percent; occurs on glacial till uplands; formed in firm till.

Canton Series. Very deep; well drained; slopes 3 to 35 percent; occurs on glaciated uplands; formed in friable till derived mainly from gneiss and schist.

MIDDLESEX COUNTY (USDA, 1991)

Hinckley-Freetown-Windsor Association (This is a continuation of the Hinckley-Merrimac-Windsor Association mapped in Worcester County):

Hinckley Series. Deep; excessively drained; nearly level to very steep; occurs on glacial outwash terraces, kames, and eskers; formed in gravely and cobbly coarse-textured glacial outwash.

PROJECT: LANDFILL REMEDIATION FEASIBILITY STUDY
 ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE
 ALL SEVEN DISPOSAL AREAS
 LOCATION: DEVENS, MASSACHUSETTS

JOB # 8712-04

DATE 24-Jan-97

ENGINEER: ABB ENVIRONMENTAL SERVICES, INC.

ESTIMATOR: P. R. MARTIN

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ANNUAL O&M COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL
O&M COSTS OCCURRING OVER FIVE YEARS FOR CSB LANDFILL				
SEDIMENT, 2 SAMPLES AT 2 LOCATIONS, ONE TIME ONLY AT YEAR 5				
METALS - ANNUALIZED	0.7239	SMPL	625.00	\$ 452
				-
GROUNDWATER MONITORING, 2 WELLS, SEMI-ANNUALLY				-
GENERAL PARAMETERS & METALS	4	SMPL	1020.00	4,080
				-
SAMPLE COLLECTION (INCLUDES WELL	2	LS	2500	5,000
PURGE, SAMPLE COLLECTION, AND SHIPMENT)				-
				-
WETLANDS RESTORATION MONITORING				-
1 DAY @ 2 MEN/DAY, SEMI-ANNUALLY	32	MNHR	75.00	2,400
				-
BIO MONITORING, BI-ANNUALLY	0.4878	LS	15000.00	7,317
				-
FIVE YEAR EDUCATION PROGRAM ONCE	0.1810	LS	2500.00	452
PUBLIC MEETING - ANNUALIZED				
FIVE YEAR SITE REVIEW - ANNUALIZED	0.1810	LS	20000.00	3,619
UNDEVELOPED DESIGN DETAILS ~25%				5,679
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 5 YEARS				\$ 29,000

Freetown Series. Deep; very poorly drained; nearly level, organic; occurs in depressions and on flat areas of uplands and glacial outwash plains.

Windsor Series. Deep; excessively drained; nearly level to very steep; occurs on glacial outwash plains, terraces, deltas, and escarpments; formed in sandy glacial outwash.

Quonset-Carver Association:

Quonset Series. Deep; excessively drained; nearly level to very steep; occurs on glacial outwash plains, terraces, eskers, and kames; formed in water-sorted sands derived principally from dark phyllite, shale, or slate.

Carver Series. Deep; excessively drained; nearly level to steep; occurs on glacial outwash plains, terraces, and deltas; formed in coarse, sandy, water-sorted material.

Winooski-Limerick-Saco Association (This is a continuation of the same association mapped along the Nashua River floodplain in Worcester County).

E.2.4 Surficial Geology

Fort Devens lies in three topographic quadrangles: Ayer, Clinton, and Shirley. The surficial geology of Fort Devens has been mapped only in the Ayer quadrangle (Jahns, 1953) and Clinton quadrangle (Koteff, 1966); the Shirley quadrangle is unmapped.

Unconsolidated surficial deposits of glacial and postglacial origin comprise nearly all of the exposed geologic materials at Fort Devens. The glacial units consist of till, deltaic deposits of glacial Lake Nashua, and deposits of glacial meltwater streams.

The till ranges from unstratified gravel to silt, and it is characteristically bouldery. Jahns (1953) and Koteff (1966) recognize a deeper unit of dense, subglacial till, and an upper, looser material that is probably a slightly younger till of englacial or superglacial origin. Till is exposed in ground-moraine areas of the Main Post (such as in the area of Lake George Street) and on the South Post at and south of Whittemore Hill. It also underlies some of the water-laid deposits (Jahns,

APPENDIX E

1953). Till averages approximately 10 feet in thickness but reaches 60 feet in drumlin areas (Koteff, 1966).

Most of the surficial glacial units in the Nashua Valley are associated with deposition in glacial Lake Nashua, which formed against the terminus of the Wisconsin ice sheet as it retreated northward along the valley. Successively lower outlets were uncovered by the retreating glacier, and the lake level was correspondingly lowered. Koteff (1966) and Jahns (1953) recognize six lake levels (stages) in the Fort Devens area, distinguished generally by the elevations and distribution of their associated deposits. The stages are, in order of development: Clinton Stage; Pin Hill Stage; Old Mill Stage; Harvard Stage; Ayer Stage; and Groton Stage.

The glacial lake deposits consist chiefly of sand and gravelly sand. Coarser materials are found in topset beds of deltas built out into the lakes and in glacial streambeds graded to the lakes. Delta foreset beds are typically composed of medium to fine sand, silt, and clay. Lake-bottom deposits, which consist of fine sand, silt, and clay, are mostly covered by delta deposits and are seldom observed in glacial Lake Nashua deposits. One of the few known exposures of glacial lake-bottom sediments in the region is on the South Post near A- and C-Ranges. There, a section of more than 14 feet of laminated clay was mined for brick-making in the early part of this century (Alden, 1925, pp. 70-71). The general physical characteristics of glacial lake deposits are the same regardless of the particular lake stage in which the deposits accumulated (Koteff, 1966; Jahns, 1953). Although glaciofluvial and glaciolacustrine sediments are typically well stratified, correlations between borings are difficult because of laterally abrupt changes characteristic of these generally high-energy depositional environments.

Postglacial deposits consist mostly of river-terrace sands and gravels; fine alluvial sands and silts beneath modern floodplains; and muck, peat, silt, and sand in swampy areas.

Jahns (1953) also observed a widespread veneer of windblown sand and ventifacts above the glacial materials (and probably derived from them in the brief interval between lake drainage and the establishment of vegetative cover).

E.2.5 Bedrock Geology

Fort Devens is underlain by low-grade metasedimentary rocks, gneisses, and granites. The rocks range in age from Late Ordovician to Early Devonian (approximately 450 million to 370 million years old). The installation is situated approximately 2 miles west of the Clinton-Newbury-Bloody Bluff fault zone, which developed when the ancestral European continental plate collided with and underthrust the ancestral North American plate. The continents re-separated in the Mesozoic to form the modern Atlantic Ocean. Fort Devens is located on the very eastern edge of the ancestral North American continental plate. A piece of the ancestral European continent (areas now east of the Bloody Bluff fault) broke off and remained attached to North America.

Preliminary bedrock maps (at scale 2,000 feet/inch) are available for the Clinton quadrangle (Peck, 1975 and 1976) and Shirley quadrangle (Russell and Allmendinger, 1975; Robinson, 1978). Bedrock information for the Ayer quadrangle is from the Massachusetts state bedrock map (at a regional scale of 4 miles/inch) (Zen, 1983) and in associated references (Robinson and Goldsmith, 1991; Wones and Goldsmith, 1991). Among these sources, there is some disagreement about unit names and stratigraphic sequence; however, there is general agreement about the distribution of rock types.

In contrast to the high metamorphic grade and highly sheared rocks of the Clinton-Newbury zone, the rocks in the Fort Devens area are low grade metamorphics (generally below the biotite isograd) and typically exhibit less brittle deformation. Major faults have been mapped, however, including the Wekepeke fault exposed west of Fort Devens (in an outcrop 0.25 mile west of the old Howard Johnson rest stop on Route 2).

Figure E-3 is a generalized summary of the bedrock geology of Fort Devens. It is compiled from Peck (1975), Robinson (1978), Russell and Allmendinger (1975), and Zen (1983), and it adopts the nomenclature of Zen (1983). Because of limited bedrock exposures, the locations of mapped contacts are considered approximate, and the mapped faults are inferred. Rock units strike generally northward to northeastward but vary locally. The bedrock units underlying Fort Devens are as follows:

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- DSw WORCESTER FORMATION** (Lower Devonian and Silurian)
Carbonaceous slate and phyllite, with minor metagraywacke to the west (Zen, 1983; Peck, 1975). Bedding is typically obscure because of a lack of compositional differences. It is relatively resistant to erosion and forms locally prominent outcrops. The abandoned Shaker slate quarry on the South Post is in rocks of the Worcester Formation. The unit corresponds to the "DSgs" and "DSs" units of Peck (1975) and the "e3" unit of Russell and Allmendinger (1975).
- So OAKDALE FORMATION** (Silurian) Metasiltstone and phyllite. It is fine-grained and consists of quartz and minor feldspar and ankerite, and it is commonly deformed by kink banding (Zen, 1983; Peck, 1975; Russell and Allmendinger, 1975). In outcrop it has alternating layers of brown siltstone and greenish phyllite. The Oakdale Formation crops out most visibly on Route 2 just east of the Jackson Gate exit. It corresponds to the "DSsp" unit of Peck (1975), the "e2" unit of Russell and Allmendinger (1975), and "ms" unit of Robinson (1978).
- Sb BERWICK FORMATION** (Silurian) Thin- to thick-bedded metamorphosed calcareous metasiltstone, biotitic metasiltstone, and fine-grained metasandstone, interbedded with quartz-muscovite-garnet schist and feldspathic quartzite (Zen, 1983; Robinson and Goldsmith, 1991). In areas northwest of Fort Devens, cataclastic zones have been observed (Robinson, 1978).
- Dcgr CHELMSFORD GRANITE** (Lower Devonian) Light-colored and gneissic, even and medium grained, quartz-microcline-plagioclase-muscovite-biotite, pervasive ductile deformation visible in elongate quartz grains aligned parallel to mica. It intrudes the Berwick Formation and Ayer granite (Wones and Goldsmith, 1991).

AYER GRANITE

- Sacgr Clinton facies** (Lower Silurian) Coarse-grained, porphyritic, foliated biotite granite with a nonporphyritic border phase; it intrudes the Oakdale and Berwick Formations and possibly the Devens-Long Pond Facies (Zen, 1983; Wones and Goldsmith, 1991).

SOad Devens-Long Pond facies (Upper Ordovician and Lower Silurian)
Gneissic, equigranular to porphyroblastic biotite granite and granodiorite. Its contact relationship with the Clinton facies is unknown (Wones and Goldsmith, 1991). Observations of mapped exposures of this unit on Fort Devens indicate that it may not be intrusive.

Bedrock is typically unweathered to only slightly weathered at Fort Devens. Glaciers stripped away virtually all of the preglacially weathered materials, and there has been insufficient time for chemical weathering of rocks in the comparatively brief geologic interval since glacial retreat.

E.2.8 Regional Hydrogeology

Fort Devens is in the Nashua River drainage basin, and the Nashua River is the eventual discharge locus for all surface water and groundwater flow at the installation.

The water of the Nashua River has been assigned to Class B under Commonwealth of Massachusetts regulations. Class B surface water is "designated for the uses of protection and propagation of fish, other aquatic life and wildlife, and for primary and secondary contact recreation" (314 CMR 4.03).

The principal tributaries of the north-flowing Nashua River at Fort Devens are Nonacoicus Brook and Walker Brook on the North Post; Cold Spring Brook (which is a tributary of Nonacoicus Brook) on the Main Post; and Spectacle Brook and Ponakin Brook (tributaries of the North Nashua River), Slate Rock Brook, and New Cranberry Pond Brook on the South Post.

There are two ponds on Fort Devens' South Post that are called Cranberry Pond. For the purpose of this report, the isolated kettle pond located east of H-Range is referred to as Cranberry Pond, and the pond impounded in the 1970s, 0.5-mile west of the Still River gate, is referred to as New Cranberry Pond.

Glacial meltwater deposits constitute the primary aquifer at Fort Devens. In aquifer tests performed as part of the Groups 2 and 7 Site Investigation (ABB-ES, 1993b), measured hydraulic conductivities in meltwater deposits were comparatively high - typically 10^{-3} to 10^{-2} centimeters per second (cm/sec). In till

APPENDIX E

and in clayey lake-bottom sediments, measured hydraulic conductivities were lower and ranged generally from 10^{-6} to 10^{-4} cm/sec. Groundwater also occurs in the underlying bedrock; however, flow is limited because the rocks have very little primary porosity and water moves primarily in fractures and dissolution voids.

Groundwater in the surficial aquifer at Fort Devens has been assigned to Class I under Commonwealth of Massachusetts regulations. Class I consists of groundwaters that are "found in the saturated zone of unconsolidated deposits or consolidated rock and bedrock and are designated as a source of potable water supply" (314 CMR 6.03).

The transmissivity of an aquifer is the product of its hydraulic conductivity and saturated thickness, and as such it is a good measure of groundwater availability. Figure E-4 shows aquifer transmissivities at Fort Devens, based on the regional work of Brackley and Hansen (1977). Transmissivities in the meltwater deposits range from 10 square feet per day (ft^2/day) to more than 4,000 ft^2/day . Aquifer transmissivities between 10 and 1,350 ft^2/day correspond to potential well yields generally between 10 and 100 gpm; transmissivities from 1,350 to 4,000 ft^2/day typically yield from 100 to 300 gpm; and where transmissivities exceed 4,000 ft^2/day , well yields greater than 300 gpm can be expected. (Most domestic wells in the area are drilled 100 to 200 feet into bedrock and yield less than 10 gpm. Higher yields are associated with deeper bedrock wells.)

In Figure E-4, the zones of highest transmissivity are found in areas of thick glacial meltwater deposits on the North and Main Posts, and these encompass the Sheboken, Patton, and McPherson production wells and the largely inactive Grove Pond wellfield. The zones of lowest transmissivity are associated with exposed till and bedrock and are located on the Main Post surrounding Shepley's Hill and between Jackson Gate and the parade ground, and on the South Post at Whittemore Hill and isolated areas to the north and west.

A regional study of water resources in the Nashua River basin was reported by Brackley and Hansen (1977). A digital model of groundwater flow at Fort Devens is available in a final report by Engineering Technologies Associates, Inc. (1994).

According to Engineering Technologies Associates, Inc. (1994), in the absence of pumping or other disturbances, groundwater recharge occurs in upland areas (e.g.,

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the high ground on the Main Post between Queenstown, Givry, and Lake George Streets, and on the South Post the area around Whittemore Hill). The groundwater flows generally from the topographic highs to topographic lows. It discharges in wetlands, ponds, streams, and directly into the Nashua River. Groundwater discharge maintains the dry-weather flow of the rivers and streams.

E.3 SHEPLEY'S HILL LANDFILL

Shepley's Hill landfill occupies approximately 84 acres in the northeast corner of the Main Post at Fort Devens (Figure E-5). The landfill has been capped according to an approved closure plan. Wastes potentially disposed of in the landfill include incinerator ash (from burning household debris), glass, spent shell casings, and asbestos. Reportedly, flammable fluids were also disposed of in the southern portion of the landfill.

Shepley's Hill Landfill is bordered to the east by Plow Shop Pond and the Boston and Maine Railroad, to the north by Nonacoicus Brook Wetland, to the west by Shepley's Hill (a large gneiss outcrop), and to the south by the DRMO area and the Main Post.

E.3.1 Geology

The following subsections describe the surficial and bedrock geology of the Shepley's Hill Landfill area.

E.3.1.1 Surficial Geology. Shepley's Hill Landfill lies within the Ayer topographic quadrangle. The surficial geology of the Ayer quadrangle was mapped in 1941 (Jahns, 1953). The soils in and around Shepley's Hill Landfill are predominantly unconsolidated, poorly graded fine to medium sands with gravel, cobbles and a silt content ranging between 1 and 15 percent. Soils in the landfill area are part of the Hinckley-Merrimack-Windsor Association and are associated with deposition in glacial Lake Nashua, which formed against the terminus of the Wisconsin ice sheet. Depositional features include a kame terrace, a glacially deposited hill of stratified sands and gravels, with an elevation of 250 feet ASL located in the northeast corner of the landfill, and prominent cross beds in an exposed channel fill feature 100 feet west of SHL-7. The uppermost portion of the unconsolidated deposits consists of fine aeolian deposited sand. Palustrine sediments, such as

APPENDIX E

peat, are probably located below fill material in the central and north-central sections of the landfill between Shepley's Hill and the kame plateau. Maps indicate that these areas were swamps prior to landfilling operations and may have been the result of a small kettle lake. Dense silt, 1 to 10 feet thick, was encountered at the overburden bedrock interface in borings SHL-1, SHL-4, SHL-16, SHL-25 (E&E, 1993), and SHM-93-01A. This silt may represent a till, and contained gravel to cobble size pieces of slightly weathered gneiss and phyllite. The unconsolidated overburden reaches a maximum observed thickness of 115 feet at both the northern and southern extents of the landfill. Across the central portion of the landfill the overburden thickness is estimated to range from 25 to 50 feet dependent on landforms. The overburden over the entire landfill has the general trend of thinning to the west where it abuts the Shepley's Hill outcrop.

Results of grain size analyses performed on subsurface soils are provided at the end of this appendix.

E.3.1.2 Bedrock Geology. The surficial soils at Shepley's Hill Landfill are underlain by low-grade phyllitic metasilts and biotite rich gneiss. The metasilts are calcareous with secondary quartz and sulfides along bedding planes and fractures. Extensive folding, banding, and foliation is also evident. The metasilts are only slightly weathered with small (0.1 to 0.5 inch) solution cavities. The bedrock core obtained from SHM-93-10C was moderately fractured in the uppermost 10 feet and became increasingly competent with depth. The fractures occurred chiefly along bedding planes although some fractures were nearly perpendicular to bedding. The foliation generally was observed to be dipping at 45 to 50 degrees, but was nearly vertical in areas. The following boreholes encountered metasilts: SHL-10, SHL-24 (E&E, 1993), SHM-93-10C, and SHM-93-22C. The bedrock core from SHM-93-22C indicates that bedrock at this location is actually a low-grade gneiss. The metasilts below Shepley's Hill Landfill belong to the Silurian Berwick Formation.

The gneiss, which appears from outcrops to be nonintrusive, is characterized by its high biotite content, gneissic foliation, and elongated feldspathic porphyroblasts. The following boreholes encountered varying metamorphic grades of gneiss: SHL-1, SHL-2, SHL-3, SHL-4, SHL-5, SHL-8, SHL-11, SHL-14, SHL-20, SHL-22 (E&E, 1993), and SHB-95-28X. The gneiss, which is associated with the Devens-Long Pond facies of the Ayer Granite (Upper Ordovician and Lower

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Silurian) is only slightly weathered. The gneiss directly underlies unconsolidated materials beneath most of the landfill outcropping to the west at Shepley's Hill and to the southwest near the DRMO yard and adjacent to the Petroleum Oil and Lubricants (POL) yard. The 20 feet of gneiss core obtained from SHM-93-22C contained only three natural fractures, all within the uppermost 10 feet. Secondary quartz and quartzite occur throughout the rock along healed fractures. Both open and healed fractures were observed to be dipping at approximately 50 degrees. The Berwick Formation metasiltstone occurs only in the southeast corner of the landfill.

Figure E-6 presents an interpretation of bedrock topography in the Shepley's Hill Landfill Area. Interpreted cross sections of the seismic survey data are provided in Figure E-7. Seismic survey lines are shown on Figure E-6. It appears that a bedrock ridge extends from SHL-1 eastward below Plow Shop Pond. The evidence supporting the existence of the ridge includes the bedrock elevation of 215.7 feet ASL, at monitoring well SHM-93-01A. This is 5 feet higher than the bedrock elevation at SHM-93-10C which is 250 feet to the northeast. This change in elevation would be consistent with the presence of a ridge aligned east-northeastward from Shepley's Hill to below Plow Shop Road. The results of the seismic survey indicated a bedrock high between SHL-3 and SHL-11 with bedrock elevations rising above 200 feet ASL. The seismic survey data may be explained by a local, closed bedrock high not just the presence of a ridge. Exposed bedrock topography also supports the existence of a ridge; the gneiss that comprises Shepley's Hill juts out to the east near SHL-1 along the line of the axis of the inferred ridge. Furthermore, the prelandfill ground surface contours in Figure E-6, and the presence of a generally coincident topographic high with a superimposed shallow swampy depression suggests a shallow bedrock substrate.

Three soil borings, SHB-95-26X, SHP-95-27X (piezometer), and SHB-95-28X were installed in the area of the proposed consolidation landfill located in the southeast corner of the existing landfill (see Figure E-6). These borings were installed to better define overburden characteristics and bedrock topography. SHB-95-26X was advanced to 51 feet bgs without encountering bedrock. SHP-95-27X and SHB-95-28X encountered bedrock at 39 and 27 feet bgs respectively. Bedrock core collected from SHB-95-28X indicated that the bedrock at this location was phyllitic metasiltstone.

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The bedrock topography along the southern boundary of the landfill is characterized by a series of hills and valleys that appear to trend roughly north-south.

Bedrock along the northern end of the landfill is characterized by a deep valley increasing in depth toward Nonacoicus Brook.

E.3.4 Groundwater Hydrology

Groundwater present in the overburden represents the primary aquifer in the Shepley's Hill Landfill area. Groundwater also occurs in the underlying bedrock; however, there is little or no primary effective porosity. Groundwater flow can occur along bedrock fractures and solution cavities. Results of quarterly water level elevation measurements are provided in Table B-1. Hydrographs of water levels collected from SHL-3, SHL-7, SHL-18, SHM-93-18B, Plow Shop Pond, and Grove Pond are provided at the end of this section. These locations were selected and data presented due to their proximity to the proposed consolidation.

Groundwater in the area flows primarily from the west-southwest to the east and north (Figure E-8). Discharge areas for groundwater around the landfill included Plow Shop Pond, the wetland north of West Main Street in Ayer, and Grove Pond. The presence of the dam in the northwest corner of Plow Shop Pond has raised the pond surface elevation in this area above the groundwater elevation, thereby locally reversing the gradient and causing water to discharge from Plow Shop Pond. The point where the gradient reverses varies seasonally depending on pond and groundwater elevation. The transition is interpreted to occur midway between SHL-20 and SHL-21. Groundwater to the north of this point flows toward the wetland, while groundwater to the south discharges to Plow Shop Pond.

Measured groundwater levels indicate a groundwater divide exists to the southwest of the landfill below the DRMO yard. The divide occurs along a northwest-southeast trending line between monitoring well 32M-92-07X and Shepley's Hill. Groundwater to the northeast of this divide flows eastward and northeastward under the southern portion of the landfill, while groundwater to the southwest of the divide flows to the southwest away from the landfill. The overburden aquifer appears to be recharged at least in part, by groundwater discharging from the bedrock along the western border of the landfill. The

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relationship between the bedrock aquifer and the overburden aquifer in the center of the cap is unknown; however, it is possible that the bedrock aquifer may also discharge to the overburden in this area. Vertical hydraulic gradients between the bedrock aquifer and the overburden aquifer were calculated from water levels collected on June 22, 1993. Calculated gradients were upwards at 0.05 feet per foot (ft/ft) between SHM-93-10C and SHL-10, 0.003 ft/ft between SHM-93-22C and SHL-22, and 0.026 ft/ft between SHL-24 and SHM-93-24A. An upward gradient of 0.004 ft/ft exists between the deep overburden well SHM-93-18B and the water table well SHL-18. No measurable vertical gradient occurred between SHL-8S and SHL-8D in the northeast corner of the landfill.

Upward vertical gradients are observed along the southeastern and eastern perimeters of Shepley's Hill Landfill, as would be expected since groundwater discharges to Plow Shop Pond. Typically upward or lack of vertical gradients are observed in the northern and northeastern portions of the landfill. The groundwater ultimately discharges to the wetland north of West Main Street and to the Nashua River.

The landfill cap covers approximately 84 acres (Biang, 1992). The cap has reduced or eliminated infiltration from precipitation, and lowered the water table beneath it. The likely result of lowering the water table has been to impart a more northerly component of flow in the southern section of the landfill, as is observed in the bend of the 225 foot contour near the southern portion of the landfill in Figure E-7. Water levels in monitoring wells SHL-12 and SHL-17 are nearly identical even though the wells are approximately 280 feet apart. ABB-ES interprets this to mean the 225-foot contour must be roughly parallel to a line between the two wells.

Permeability testing of the Shepley's Hill Landfill monitoring wells produced hydraulic conductivity estimates ranging from 1×10^{-2} cm/sec (SHL-19) to 9×10^{-5} cm/sec (SHL-25) for the unconfined overburden aquifer, and 3×10^{-2} cm/sec (SHL-20) to 5×10^{-8} cm/sec (SHL-24) for the bedrock aquifer. The geometric mean of the hydraulic conductivities was calculated to be 3×10^{-3} cm/sec with a standard deviation of 2×10^{-2} . These values were determined by the method of Bouwer and Rice (1976). Hydraulic conductivity values as determined by both the Hvorslev (1951) and Bouwer and Rice methods as well as transmissivity values are provided in Table B-2.

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In November 1993 Engineering Technologies Associates, Inc. performed an aquifer pumping test on the bedrock monitoring well SHM-93-10C. Analyses of the test data indicated that the bedrock aquifer responded with the characteristics of both a porous and fractured media (ETA, 1995). Reliable values of transmissivity derived from the test data ranged from 2.9 ft²/day to 4.0 ft²/day. The storage coefficient was calculated as 1.15×10^{-7} . The test data showed that there was significant leakage into the bedrock aquifer from the overburden sands (ETA, 1995).

Groundwater modeling utilizing MODFLOWP was conducted for the Shepley's Hill Landfill area as part of the Feasibility Study (ABB, 1994). Two layers were used to simulate groundwater flow, the overburden and bedrock. Calibration of the model resulted in a hydraulic conductivity for the overburden of 40 ft/day (0.014 cm/sec) and a specific yield of 0.05. The bedrock aquifer was assigned a transmissivity of 36 ft²/day. The model was run for 100 years with an average recharge of 19 inches/year. Two runs were performed, one with the current landfill cap configuration and one with no landfill cap, to quantify the impact of the landfill cap on groundwater. The models indicated that the presence of the landfill cap reduces groundwater flow to Plow Shop Pond by 71 percent with most of the flow being diverted to the north of the landfill near Nonacoicus Brook Wetland. Flow to Grove Pond, and the eastern and southern boundaries of the model are not significantly impacted by the landfill cap.

ETA completed a basewide flow model and Zone II delineation for the production wells located on Fort Devens (ETA, 1995). The results of the basewide flow model support the interpreted flow directions derived from the water level data. The Zone II delineation for the Grove Pond Well field and the Town of Ayer well is shown on Figure E-8.

E.3.5 Surface Water Hydrology

Shepley's Hill Landfill is bordered to the northeast by Plow Shop Pond, a shallow, 30 acre pond outside the installation boundary. The water level in Plow Shop Pond is maintained by two dams, one in the northwest corner on Nonacoicus Brook and one on the north side of the pond near Moores Lumber Yard. Flow into Plow Shop Pond is through a culvert from Grove Pond to the east. The railroad causeway separating Plow Shop Pond and Grove Pond is thought to have been constructed in the late 1800s. Before construction of the causeway and dams, Plow Shop Pond and Grove Pond were most likely a continuous swampy

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area fed by a number of small streams. Nonacoicus Brook flows approximately 1 mile to the northwest from Plow Shop Pond before it discharges to the Nashua River. A wetland borders the brook and is a local groundwater discharge area north of West Main Street in Ayer. The area surrounding Nonacoicus Brook to the south of West Main Street is referred to as Nonacoicus Brook Wetland, but only has standing water during flood events suggesting that this is not a local discharge area. The area bordering Nonacoicus Brook to the north of West Main Street has surface water all year indicating that this may be a local discharge area.

Two storm sewer system outfalls are located along the southern perimeter of Shepley's Hill Landfill near SHL-12 and SHL-17 (see Figure E-8). The system, designated System #14 (ADL, 1994), drains an area occupied by barracks and an unpaved vehicle storage area located in the vicinity of the intersection of Market and Carey Streets. A surface water drainage ditch runs from the outfalls along the eastern portion of the landfill cap and discharges into Plow Shop Pond. The drainage ditch has only been observed to contain flowing water during spring flood events (March 1993).

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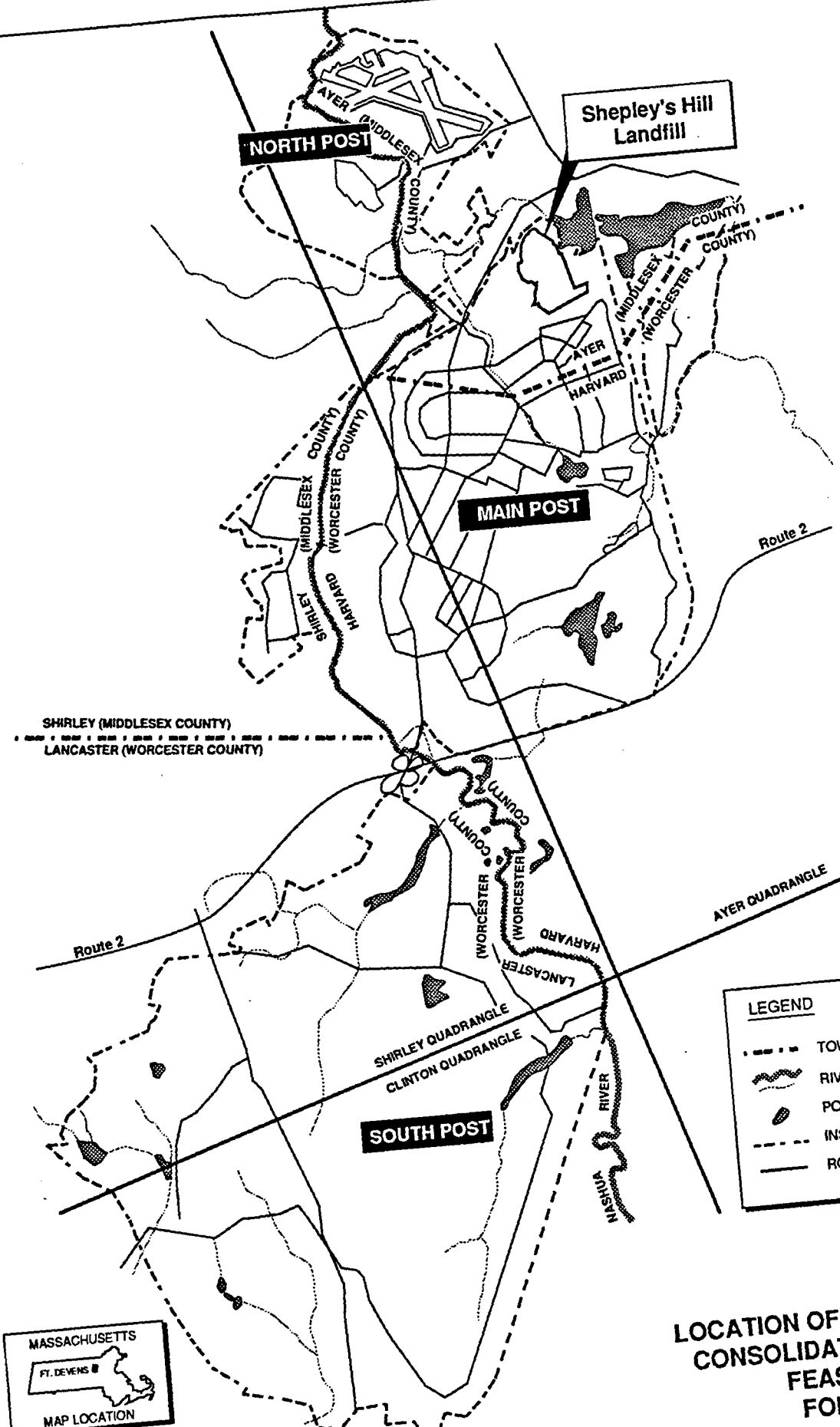
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LEGEND

- - - TOWN LINE
- ~~~~~ RIVER/BROOK
- POND/LAKE
- - - INSTALLATION BOUNDARY
- ROADS/ HIGHWAY

MASSACHUSETTS

MAP LOCATION

SCALE IN FEET

0 3000 6000

**LOCATION OF FORT DEVENS
CONSOLIDATION LANDFILL
FEASIBILITY STUDY
FORT DEVENS, MA**

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ROUTE 2



LEGEND

- RIVER/BROOK
- POND/LAKE
- INSTALLATION BOUNDARY
- ROADS/HIGHWAY

ASSOCIATION

- QUONSET-CARVER (QC)
- WINOOSKI-LIMERICK-SACO (WLS)
- HINCKLEY-MERRIMAC (FREETOWN)-WINDSOR (HMW)
- PAXTON-WOODBRIDGE-CANTON (PWC)

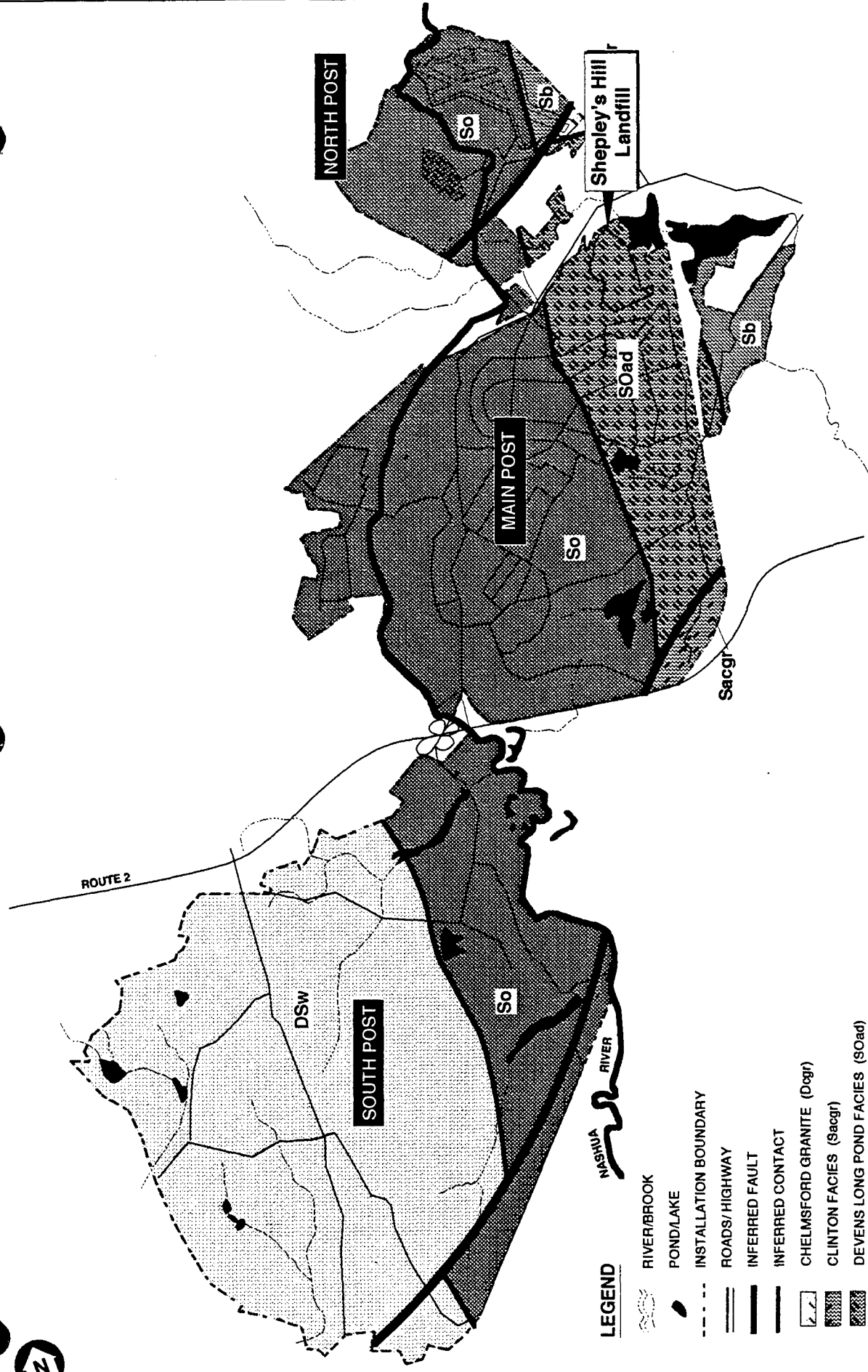
SCALE IN FEET



SOURCE: SCS (1985 and 1989)

**GENERAL SOILS MAP
CONSOLIDATION LANDFILL
FEASIBILITY STUDY
FORT DEVENS, MA**

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LEGEND

- RIVER/BROOK
- POND/LAKE
- INSTALLATION BOUNDARY
- ROADS/HIGHWAY
- INFERRED FAULT
- INFERRED CONTACT
- CHELMSFORD GRANITE (Dogr)
- CLINTON FACIES (Sacgr)
- DEVENS LONG POND FACIES (SOad)
- WORCESTER FORMATION (DSw)
- OAKDALE FORMATION (So)
- BERWICK FORMATION (Sb)

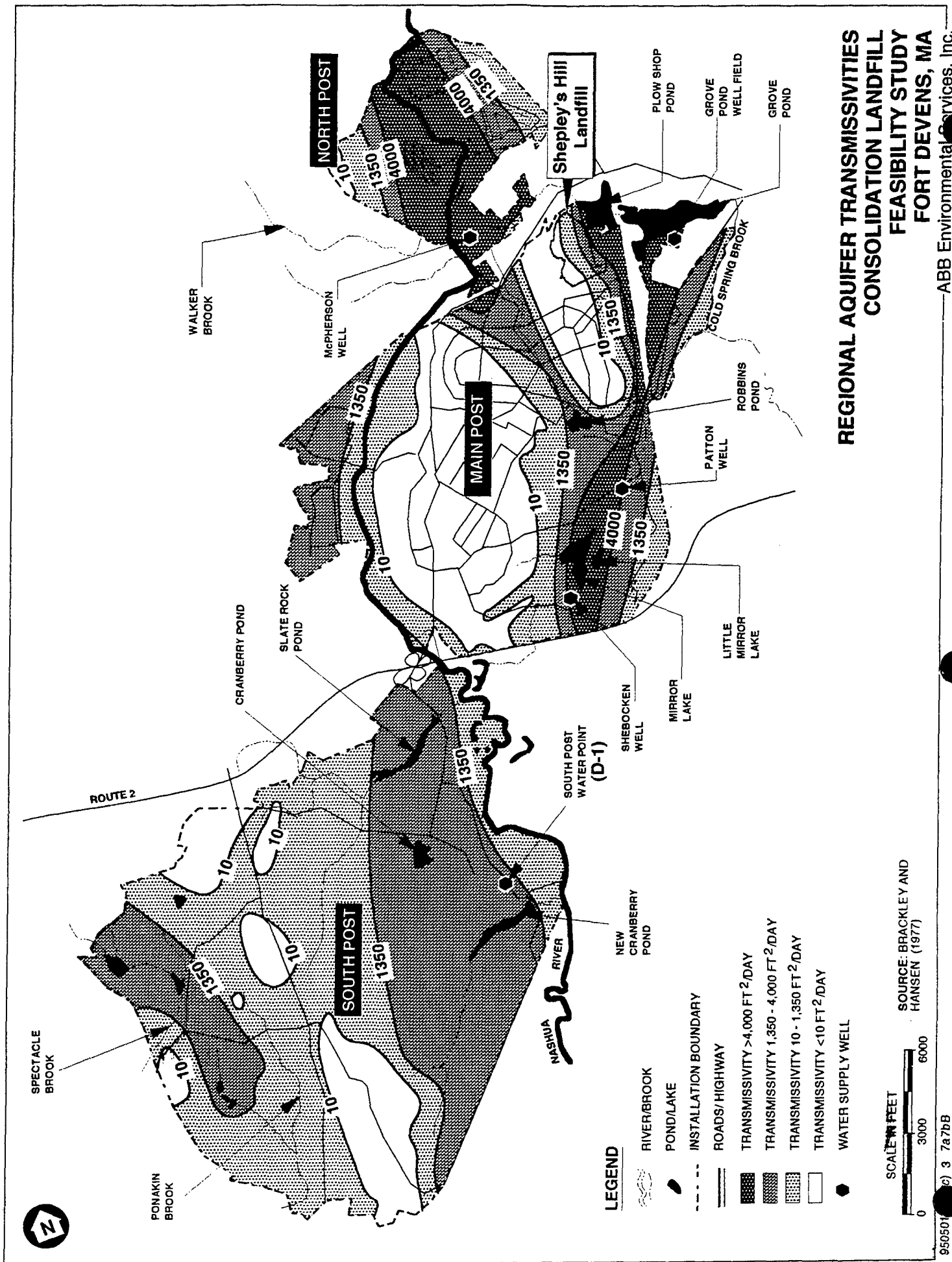
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SOURCE: ZEN (1983); PECK (1975),
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AND ROBINSON (1978).

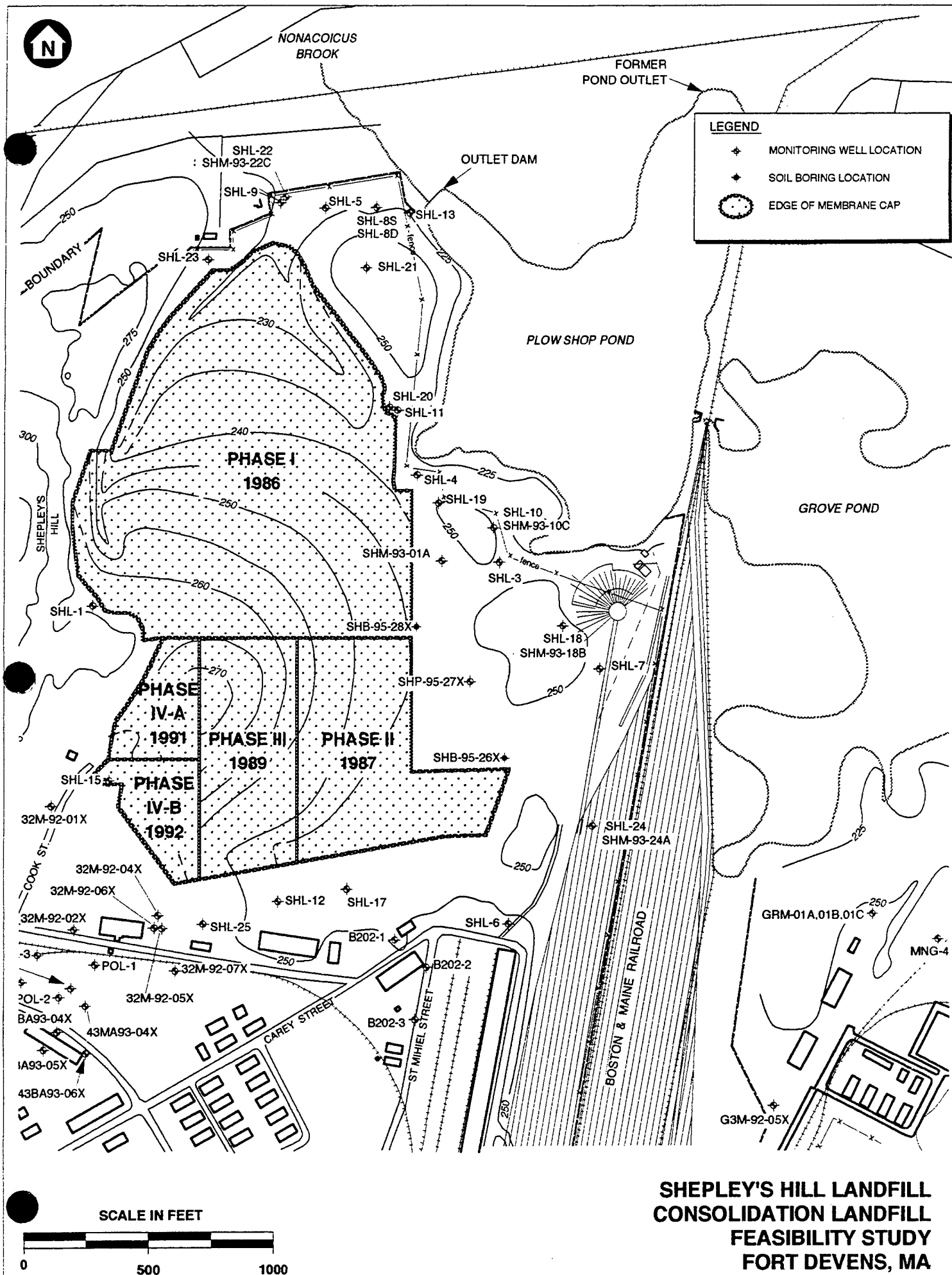
**BEDROCK GEOLOGY
CONSOLIDATION LANDFILL
FEASIBILITY STUDY
FORT DEVENS, MA**

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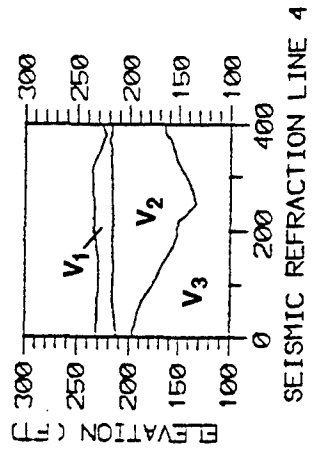
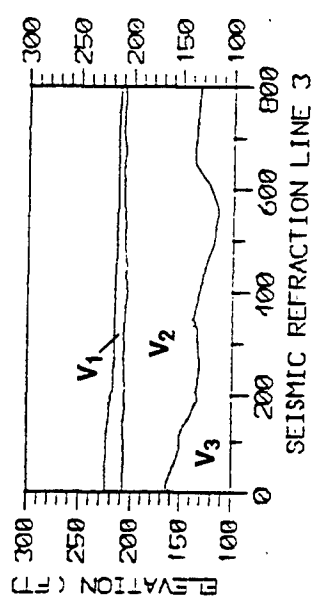
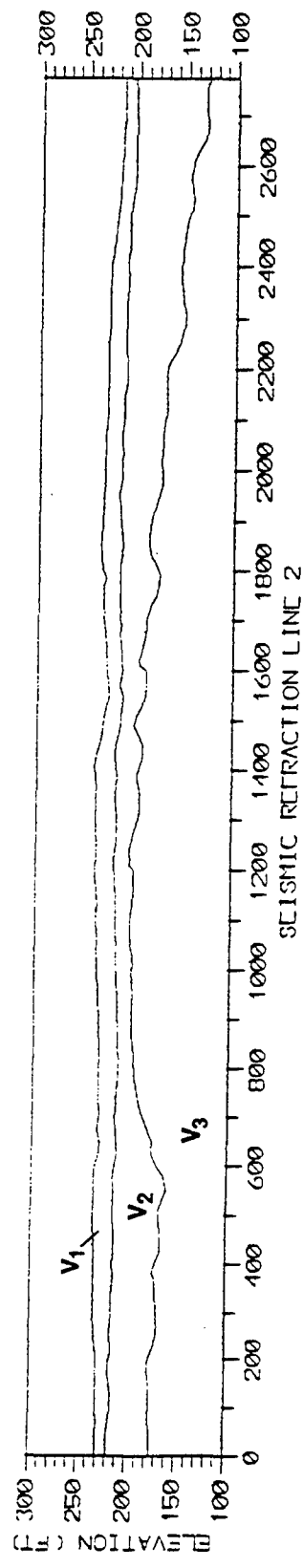
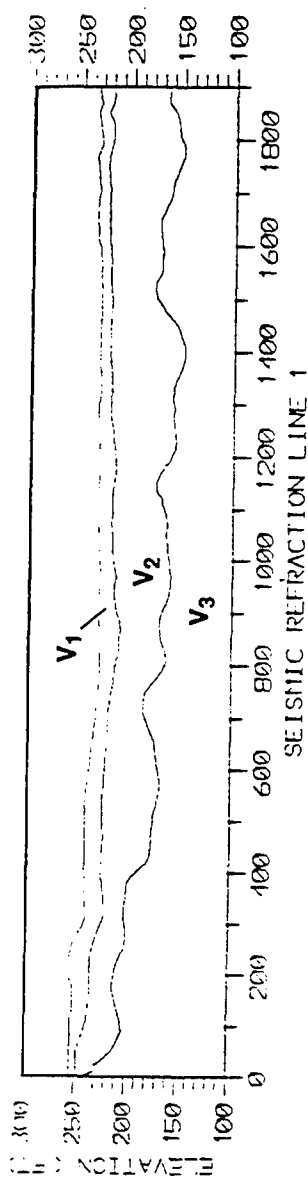
REGIONAL AQUIFER TRANSMISSIVITIES CONSOLIDATION LANDFILL FEASIBILITY STUDY FORT DEVENS, MA

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**SHEPLEY'S HILL LANDFILL
CONSOLIDATION LANDFILL
FEASIBILITY STUDY
FORT DEVENS, MA**

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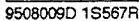
LEGEND

- V1 = 800 TO 1,600 fps. LOOSE, UNCONSOLIDATED AND UNSATURATED OVERBURDEN.
- V2 = 4,000 TO 5,200 fps. SATURATED, UNCONSOLIDATED OVERBURDEN.
- V3 = 12,000 TO 18,000 fps. BEDROCK, HIGHER VALUES MAY INDICATE RELATIVELY MORE COMPETENT ZONES; LOWER VALUE MAY INDICATE WEATHERED AND/OR FRACTURED ZONES.

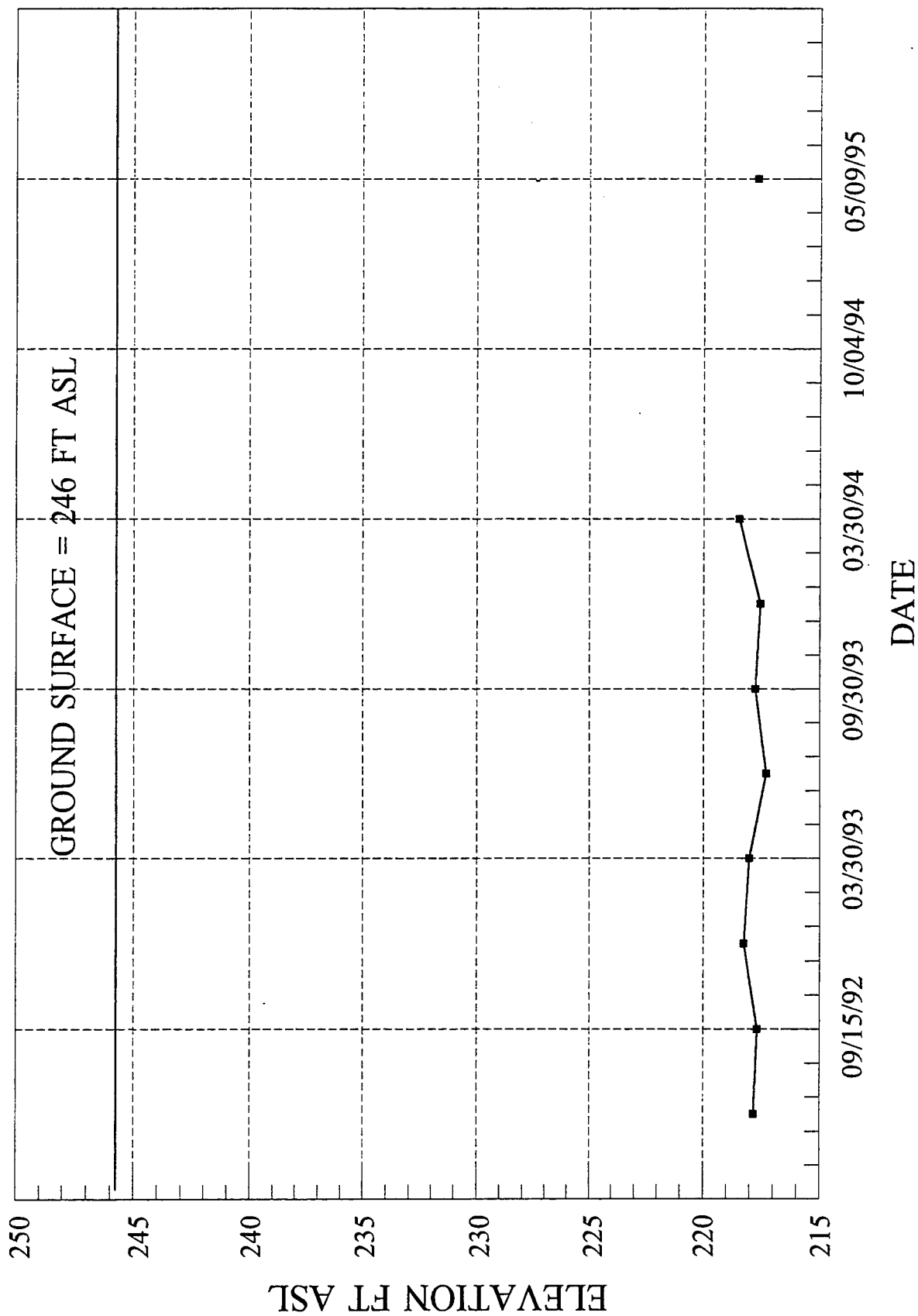
NOTES:

1. GROUND SURFACE IS FROM SURVEY DATA PROVIDED BY HOWE SURVEYING ASSOCIATES, NO. CHELMSFORD, MA.
2. SEISMIC VELOCITY VALUES ARE IN FEET PER SECOND.
3. DASHED LINES INDICATE SOME UNCERTAINTY IN THE INTERPRETATION OF SEISMIC DATA.
4. VERTICAL EXAGGERATION IS 2:1.

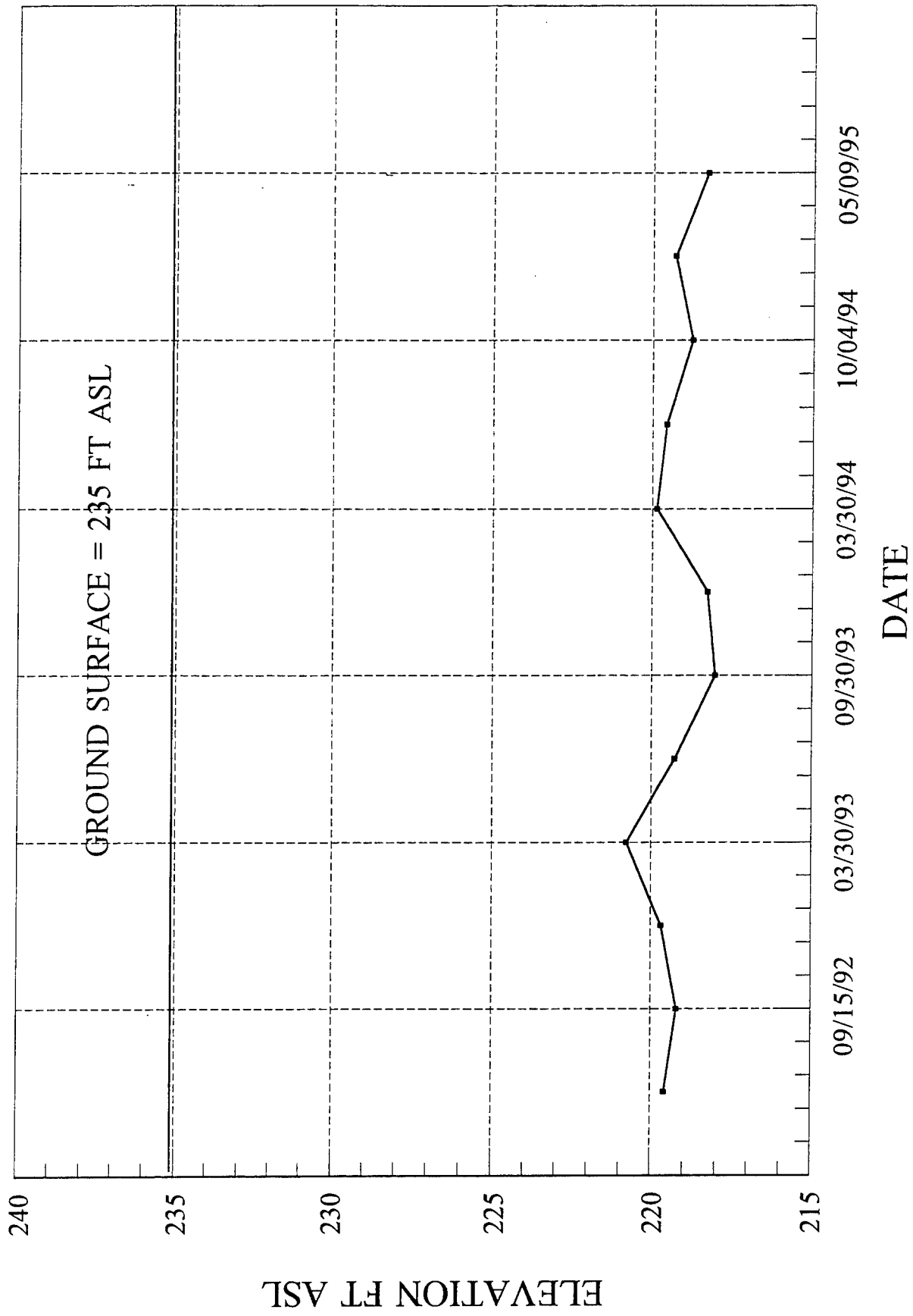
**SEISMIC REFRACTION PROFILES
SHEPLEY'S HILL LANDFILL
CONSOLIDATION LANDFILL
FEASIBILITY STUDY
FT. DEVENS, MA**



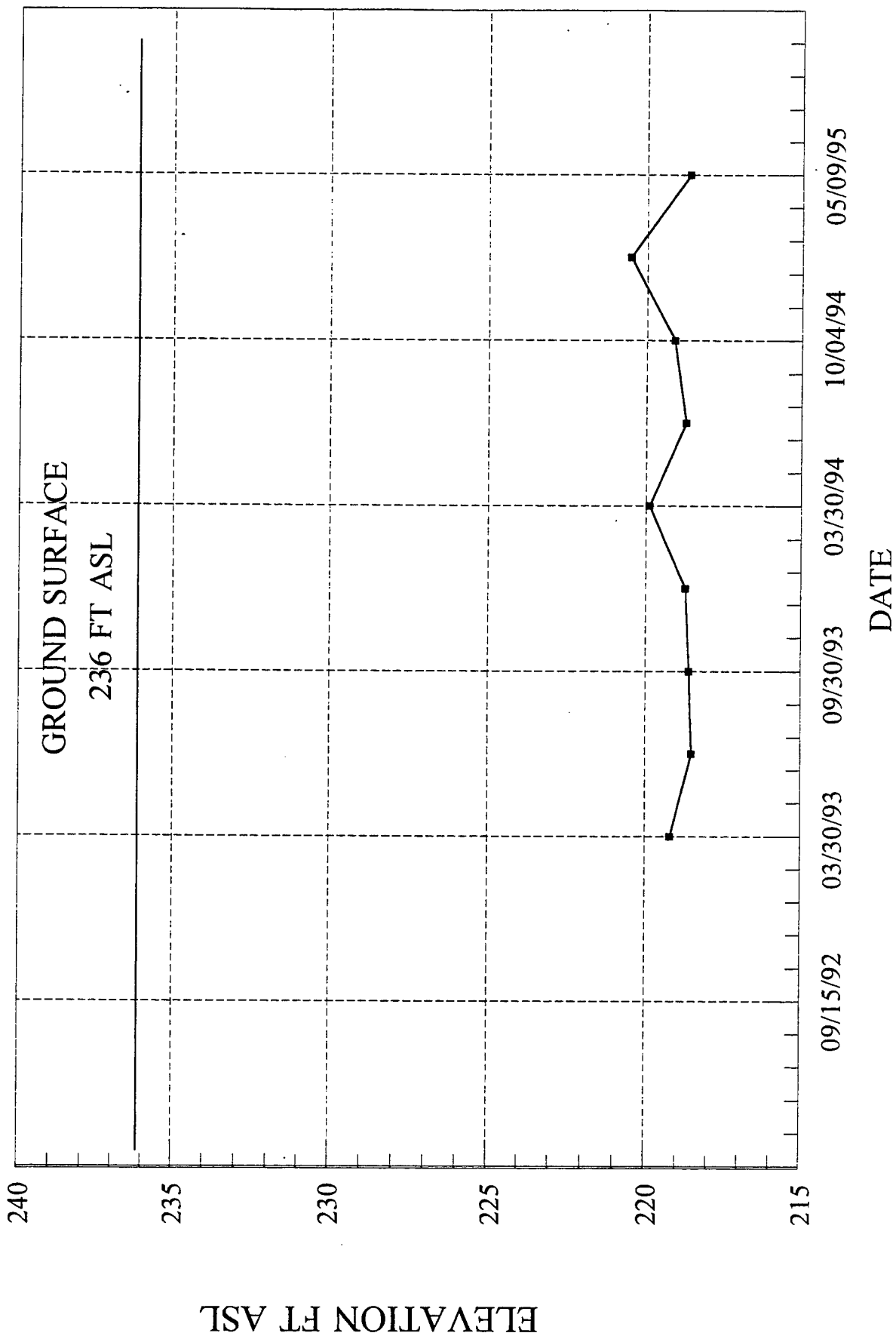
CONSOLIDATION LANDFILL
SHL-3 ELEVATION OF GROUNDWATER



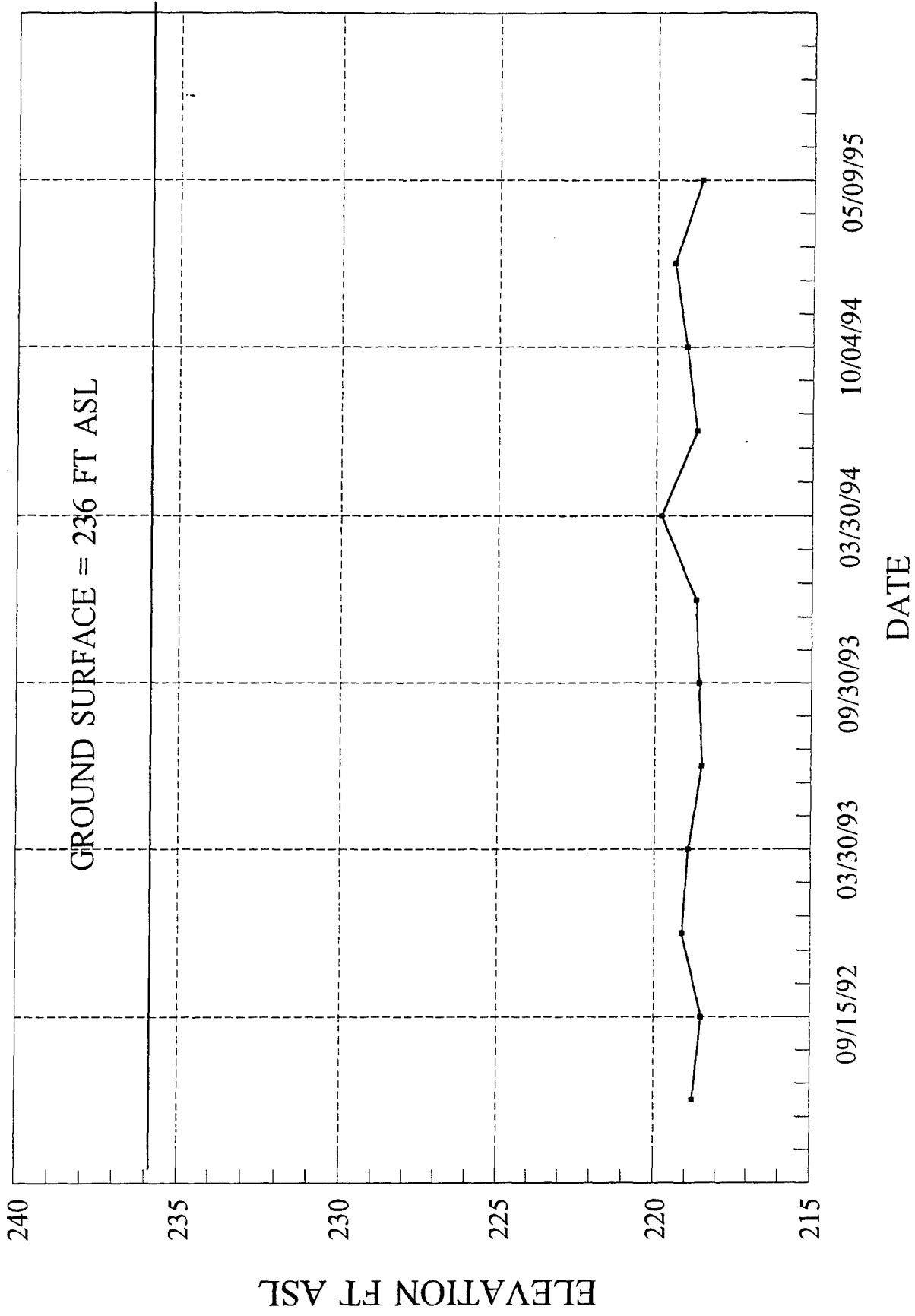
CONSOLIDATION LANDFILL
SHL-7 ELEVATION OF GROUNDWATER



CONSOLIDATION LANDFILL
SHM-93-18B

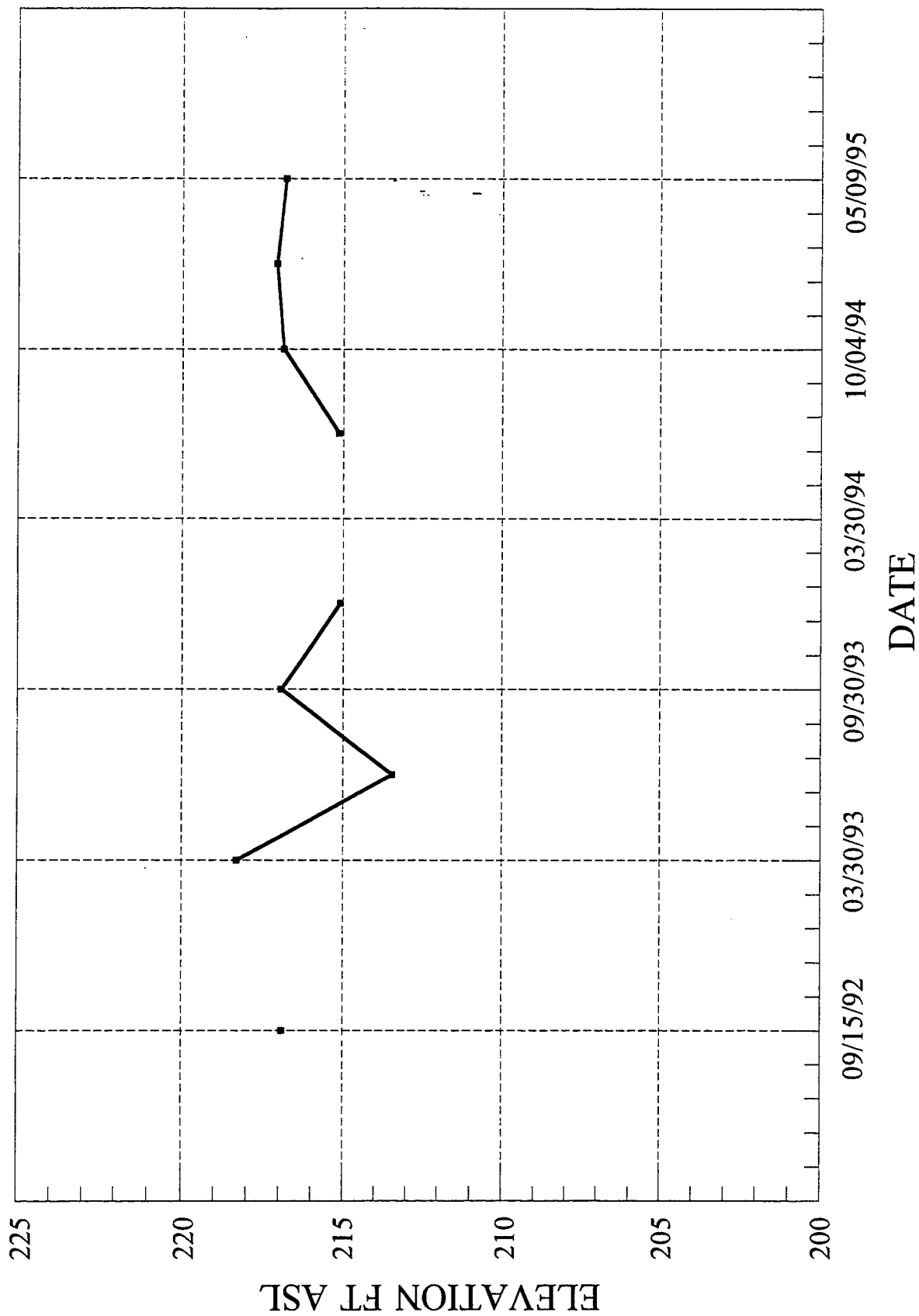


CONSOLIDATION LANDFILL
SHL-18 ELEVATION OF GROUNDWATER

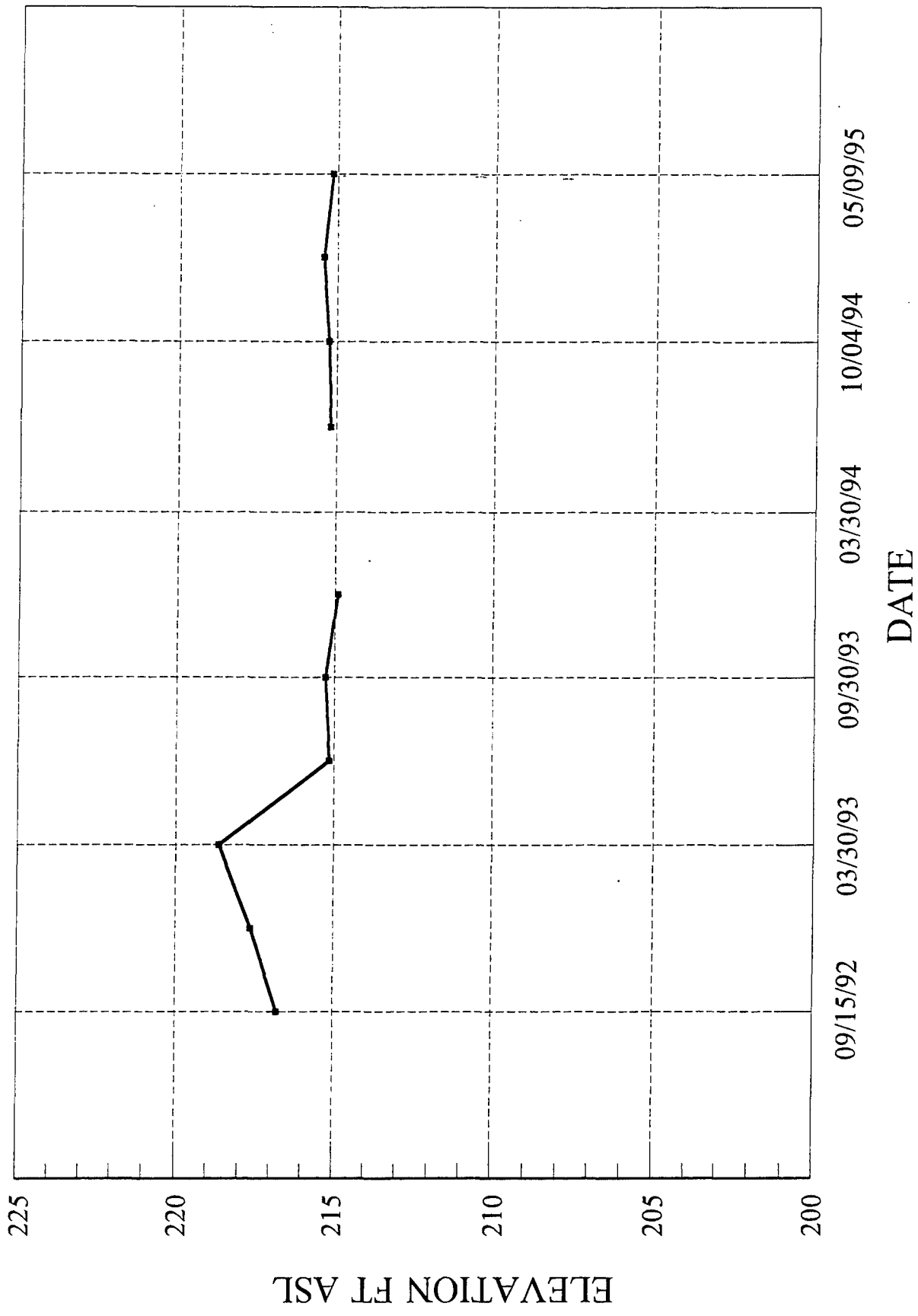


CONSOLIDATION LANDFILL

PLOW SHOP POND SURFACE ELEVATION



CONSOLIDATION LANDFILL
GROVE POND SURFACE ELEVATION



SYNOPTIC WATER-LEVEL MEASUREMENTS

FORT DEVENS, MA

STATION/ WELL NO.	REF POINT	ELEV. OF REF. PT.	MAY 26, 1992		SEPT. 15, 1992		DECEMBER 22, 1992	
			DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER
MNG-1	PVC	248.89	24.55	224.34	24.6	224.29	Not measured	Not measured
MNG-2	PVC	238.66	20.36	218.3	20.67	217.99	20.23	218.43
MNG-3	PVC	254.47	37.52	216.95	37.35	217.12	36.84	217.63
MNG-4	PVC	254.37	32.80	221.57	32.98	221.39	Not measured	Not measured
MNG-5	PVC	237.21	17.28	219.93	17.48	219.73	17.58	219.63
MNG-6	PVC	254.70	36.46	218.24	36.52	218.18	36.22	218.48
MNG-7	PVC	250.08	31.43	218.65	31.39	218.69	31.38	218.7
SWEL-05	CAPPED PIN	217.84		217.84	1.05	216.79	0.22	217.62
SHL-1	PVC		Dry	Dry	Dry	Dry	Not measured	Not measured
SHL-3H	PVC	248.17	Not measured	Not measured	Not measured	Not measured	Not measured	Not measured
SHL-3L	CASING	248.50	30.67	217.83	30.82	217.68	30.24	218.26
SHL-4	PVC	228.71	11.10	217.61	11.23	217.48	10.58	218.13
SHL-5	PVC	218.53	4.10	214.43	5.15	213.38	2.39	216.14
SHL-6	CASING	254.17	28.80	225.37	29.11	225.06	29.38	224.79
SHL-7	PVC	237.13	17.56	219.57	17.93	219.2	17.45	219.68
SHL-8	PVC	221.85	7.53	214.32	8.22	213.63	7.1	214.75
	PVC-2-INCH	221.66	7.70	213.96	8.4	213.26	6.92	214.74
SHL-9	PVC	222.86	9.15	213.71	10.01	212.85	8.21	214.65
SHL-10	PVC	248.80	31.19	217.61	31.41	217.39	30.8	218
SHL-11	PVC	236.34	18.87	217.47	19.02	217.32	18.65	217.69
SHL-12	PVC	249.51	23.25	226.26	23.59	225.92	23.88	225.63
SHL-13	PVC	221.58	7.05	214.53	7.66	213.92	6.61	214.97
SHL-15	PVC	260.75	17.92	242.83	19.42	241.33	19.08	241.67
SHL-17	PVC	234.57	8.46	226.11	8.8	225.77	8.97	225.6
SHL-18	PVC	238.39	19.63	218.76	19.9	218.49	19.28	219.11
SHL-19	PVC	241.34	23.29	218.05	23.5	217.84	22.45	218.89
SHL-20	PVC	236.84	19.24	217.6	19.47	217.37	19.07	217.77
SHL-21	PVC	259.75	45.34	214.41	46.01	213.74	44.8	214.95
SHL-22	PVC	220.49	6.73	213.76	7.54	212.95	5.91	214.58
SHL-23	PVC	242.14	27.27	214.87	28.52	213.62	26.45	215.69
SHL-24	PVC	239.60	16.92	222.68	16.78	222.82	16.74	222.86
SHL-25	PVC	258.87	24.68	234.19	26.78	232.09	26.86	232.01
POL-1	PVC	259.77	19.14	240.63	19.99	239.78	19.04	240.73
POL-2	PVC	259.42	27.70	231.72	28.29	231.13	29.38	230.04
POL-3	PVC	261.94	25.42	236.52	26.8	235.14	26.74	235.2
B202-1	PVC	254.43	28.30	226.13	28.62	225.81	28.93	225.5
B202-2	PVC	258.37	32.05	226.32	32.3	226.07	32.76	225.61
B202-3	PVC	258.32	31.28	227.04	31.51	226.81	32.13	226.19
SWEL-04	TOP OF STAKE	218.00	Not measured	Not measured	1.1	216.9	Not measured	Not measured

SYNOPTIC WATER-LEVEL MEASUREMENTS

FORT DEVENS

STATION/ WELL NO.	REF. POINT	ELEV. OF REF. PT.	MARCH 1993		JUNE 22, 1993		SEPTEMBER 30, 1993	
			DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER
MNG-1	PVC	248.89	Not Measured	Not Measured	24.22	224.67	25.34	Not measured
MNG-2	PVC	238.66	19.64	219.02	20.52	218.14	20.59	218.07
MNG-3	PVC	254.47	35.94	218.53	37.26	217.21	37.16	217.31
MNG-4	PVC	254.37	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
MNG-5	PVC	237.21	17.14	220.07	17.27	219.94	Not Measured	Not Measured
MNG-6	PVC	254.70	35.75	218.95	36.37	218.33	36.52	218.18
MNG-7	PVC	250.08	31.06	219.02	Not Measured	Not Measured	35.89	214.19
SWEL-05	CAPPED PIN	217.84	-0.80	218.64	Stake Missing	Stake Missing	Stake Missing	Stake Missing
SWEL-GRP(P)	TOP OF PIPE	216	Not Measured	Not Measured	0.86	215.14	0.72	215.28
SHL-1	PVC	272.74	2.45	270.29	Dry	Dry	5.93	Not measured
SHL-3H	PVC	248.17	Not Measured	Not Measured	30.87	217.3	30.74	Not measured
SHL-3L	CASING	248.50	30.49	218.01	-	-	-	217.76
SHL-4	PVC	228.71	10.36	218.35	11.18	217.53	11.09	217.62
SHL-5	PVC	218.53	1.81	216.72	4.88	213.65	3.22	215.31
SHL-6	CASING	254.17	28.76	225.41	28.7	225.47	29.58	224.59
SHL-7	PVC	237.13	16.35	220.78	17.85	219.28	19.09	218.04
SHL-8	PVC	221.85	6.78	215.07	8.05	213.8	8.03	213.82
	PVC-2-INCH	221.66	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
SHL-9	PVC	222.86	8.03	214.83	9.62	213.24	9.83	213.03
SHL-10	PVC	248.80	30.99	217.81	31.4	217.4	31.31	217.49
SHL-11	PVC	236.34	18.40	217.94	18.96	217.38	19.01	217.33
SHL-12	PVC	249.51	22.38	227.13	22.96	226.55	23.91	225.6
SHL-13	PVC	221.58	7.61	213.97	7.35	214.23	7.23	214.35
SHL-15	PVC	260.75	71.12	189.63	18.22	242.53	19.1	241.65
SHL-17	PVC	234.57	5.54	229.03	8.21	226.36	8.9	225.67
SHL-18	PVC	238.39	19.48	218.91	19.9	218.49	19.8	218.59
SHL-19	PVC	241.34	23.13	218.21	23.51	217.83	23.25	218.09
SHL-20	PVC	236.84	18.89	217.95	19.35	217.49	19.46	217.38
SHL-21	PVC	259.75	45.15	214.6	45.58	214.17	46.15	213.6
SHL-22	PVC	220.49	5.90	214.59	7.31	213.18	7.43	213.06
SHL-23	PVC	242.14	27.53	214.61	27.96	214.18	28.67	213.47
SHL-24	PVC	239.60	15.89	223.71	16.5	223.1	17.05	222.55
SHL-25	PVC	258.87	24.42	234.45	24.95	233.92	28.6	230.27
SHM-93-01A	PVC	243.22	22.17	221.05	22.8	220.42	23.59	219.63
SHM-93-10C	PVC	248.42	29.96	218.46	30.47	217.95	30.5	217.92
SHM-93-18B	PVC	238.12	18.93	219.19	19.6	218.52	19.51	218.61
SHM-93-22C	PVC	219.76	7.04	212.72	8.35	211.41	8.51	211.25
SHM-93-24A	PVC	239.25	15.95	223.3	17.04	222.21	17.51	221.74
POL-1	PVC	259.77	15.30	244.47	19.4	240.37	19.26	240.51
POL-2	PVC	259.42	28.02	231.4	26.81	232.61	30.73	228.69
POL-3	PVC	261.94	23.90	238.04	25.67	236.27	27.01	234.93
43MA93-04X	PVC	261.37	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
43MA93-05X	PVC	260.55	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
43MA93-06X	PVC	262.89	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
43MA93-047	PVC	259.63	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
43MA93-08X	PVC	260.29	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
43MA93-10X	PVC	260.41	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
B202-1	PVC	254.43	27.47	226.96	28.07	226.36	28.86	225.57
B202-2	PVC	258.37	32.20	226.17	31.8	226.57	32.92	225.45
B202-3	PVC	258.32	31.48	226.84	30.99	227.33	32.28	226.04
SWEL-04	TOP OF STAKE	218.00	-0.30	218.3	4.55	213.45	Not Measured	Not Measured
SWEL-PSP(P)	TOP OF STAKE	221.35	Not Measured	Not Measured	Not Measured	Not Measured	4.42	216.93

SYNOPTIC WATER-LEVEL MEASUREMENTS

FORT DEVENS, MA

STATION/ WELL NO.	REF. POINT	ELEV. OF REF. PT.	NOVEMBER 8, 1993		MARCH 30, 1994		JUNE 28, 1994	
			DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER
MNG-1	PVC	248.89	25.42	223.47	24.54	224.35	23.82	225.07
MNG-2	PVC	238.66	20.71	217.95	19.61	219.05	20.43	218.23
MNG-3	PVC	254.47	37.27	217.2	36.09	218.38	37.27	217.2
MNG-4	PVC	254.37	Not Measured	Not Measured	Not Measured	Not Measured	0	Not Measured
MNG-5	PVC	237.21	17.95	219.26	17	220.21	17.03	220.18
MNG-6	PVC	254.70	36.62	218.08	35.71	218.99	36.33	218.37
MNG-7	PVC	250.08	35.97	214.11	35.12	Not Measured	17.55	232.53
SWEL-01	BRIDGE RAIL	221.16	21.46	199.7	16.25	204.91	0	Not Measured
SWEL-02	BRIDGE RAIL	217.82	16.08	201.74	10.73	207.09	0	Not Measured
SWEL-05	CAPPED PIN	217.84	Not Measured	Not Measured	Stake Missing	Stake Missing	0	Stake Missing
SWEL-GRP(P)	TOP OF PIPE	216	1.1	214.9	Stake Missing	Stake Missing	0.82	215.18
SHL-1	PVC	272.74	Dry	Dry	2.04	Dry	0	Dry
SHL-3H	PVC	248.17	30.63	217.54	Stake Missing	Stake Missing	?	Not measured
SHL-3L	CASING	248.50	Not Measured	Not Measured	29.7	218.8	?	-
SHL-4	PVC	228.71	11.13	217.58	10.42	218.29	0	Not measured
SHL-5	PVC	218.53	3.14	215.39	1.68	216.85	4.67	213.86
SHL-6	CASING	254.17	29.62	224.55	27.76	226.41	28.11	226.06
SHL-7	PVC	237.13	18.84	218.29	17.27	219.86	17.55	219.58
SHL-8	PVC	221.85	7.69	214.16	6.28	215.57	?	221.85
	PVC-2-INCH	221.66	Not Measured	Not Measured	6.14	215.52	?	Not Measured
SHL-9	PVC	222.86	9.08	213.78	7.09	215.77	9.28	213.58
SHL-10	PVC	248.80	31.17	217.63	30.24	218.56	31.3	217.5
SHP-93-10E	CASING						30.19	-30.19
SHP-93-10D	CASING						30.86	-30.86
SHL-11	PVC	236.34	19.05	217.29	18.25	218.09	18.86	217.48
SHL-12	PVC	249.51	24.20	225.31	21.9	227.61	22.34	227.17
SHL-13	PVC	221.58	7.08	214.5	5.67	215.91	7.22	214.36
SHL-15	PVC	260.75	18.94	241.81	15.55	245.2	17.86	242.89
SHL-17	PVC	234.57	9.31	225.26	6.99	227.58	0	Not Measured
SHL-18	PVC	238.39	19.68	218.71	18.55	219.84	19.69	218.7
SHL-19	PVC	241.34	23.27	218.07	22.54	218.8	23.24	218.1
SHL-20	PVC	236.84	19.49	217.35	18.69	218.15	19.21	217.63
SHL-21	PVC	259.75	45.47	214.28	44.6	215.15	45.28	214.47
SHL-22	PVC	220.49	6.75	213.74	5.18	215.31	6.97	213.52
SHL-23	PVC	242.14	27.49	214.65	25.9	216.24	27.31	214.83
SHL-24	PVC	239.60	16.98	222.62	15.25	224.35	16.03	223.57
SHL-25	PVC	258.87	27.06	231.81	21.21	237.66	23.92	234.95
SHM-93-01A	PVC	243.22	22.25	220.97	20.93	222.29	22.33	220.89
SHM-93-10C	PVC	248.42	30.41	218.01	29.46	218.96	30.37	218.05
SHM-93-18B	PVC	238.12	19.38	218.74	18.24	219.88	19.38	218.74
SHM-93-22C	PVC	221.55	7.8	213.75	6.2	215.35	8.06	213.49
SHM-93-24A	PVC	239.25	17.41	221.84	15.62	223.63	16.61	222.64
POL-1	PVC	259.77	19.24	240.53	16.65	243.12	19.25	240.52
POL-2	PVC	259.42	29.25	230.17	26.89	232.53	25.78	233.64
POL-3	PVC	261.94	26.68	235.26	22.6	239.34	25.25	236.69
43MA93-04X	PVC	261.37	30.59	230.78	26.74	234.63	27.28	234.09
43MA93-05X	PVC	260.55	33.4	227.15	Not Measured	Not Measured	30.47	230.08
43MA93-06X	PVC	262.89	33.33	229.56	29.86	233.03	29.86	233.03
43MA93-07X	PVC	259.63	30.13	229.5	26.62	233.01	26.7	232.93
43MA93-08X	PVC	260.29	30.2	230.09	26.04	234.25	26.6	233.69
43MA93-10X	PVC	260.41	29.86	230.55	26.02	234.39	26.43	233.98
B202-1	PVC	254.43	29.19	225.24	27.05	227.38	27.43	227
B202-2	PVC	258.37	32.96	225.41	31.07	227.3	31.19	227.18
B202-3	PVC	258.32	32.31	226.01	30.53	227.79	30.28	228.04
SWEL-04	TOP OF STAKE	218.00	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	?
SWEL-PSP(P)	TOP OF STAKE	219.6	4.52	215.08	Not Measured	Not Measured	4.47	215.13
G3M-92-05X	PVC	254.30	30.56	223.74	29.65	224.65	28.85	225.45
GRM-01A	PVC	253.31	32.83	220.48	31.59	188.89	31.8	221.51
GRM-01B	PVC	252.9	34.03	218.87	32.85	186.02	33.62	219.28
GRM-01C	PVC	253.48	34.61	218.87	3.42	215.45	34.2	219.28

SYNOPTIC WATER-LEVEL MEASUREMENTS

FORT DEVENS

STATION/	REF. POINT	ELEV. OF REF. PT.	OCTOBER 4, 1994		JANUARY 31, 1995		MAY, 1995	
			DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	WATER
MNG-1	PVC	248.89	Not Measured	Not Measured	24.14	224.75	24.23	224.66
MNG-2	PVC	238.66	20.2	218.46	20.02	218.64	20.35	218.31
MNG-3	PVC	254.47	37.06	217.41	36.72	217.75	37.12	217.35
MNG-4	PVC	254.37	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
MNG-5	PVC	237.21	Not Measured	Not Measured	17	220.21	17.17	220.04
MNG-6	PVC	254.70	Not Measured	Not Measured	35.9	218.8	36.21	218.49
MNG-7	PVC	250.08	35.47	214.61	35.24	214.84	35.43	214.65
SWEL-05	CAPPED PIN	217.84	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
SWEL-GRP(P)	TOP OF PIPE	216	0.75	215.25	0.56	215.44	0.85	215.15
SHL-1	PVC	272.74	Not Measured	Not Measured	Not Measured	Not Measured	Dry	Not Measured
SHL-3H	PVC	248.17		248.17	Not Measured	Not Measured	Dry	Not Measured
SHL-3L	CASING	248.50		248.5	Not Measured	Not Measured	30.83	217.67
SHL-4	PVC	228.71	11	217.71	10.78	217.93	11.04	217.67
SHL-5	PVC	218.53	3.35	215.18	2.88	215.65	4.29	214.24
SHL-6	CASING	254.17	28.35	225.82	28.18	225.99	28.74	225.43
SHL-7	PVC	237.13	18.35	218.78	17.81	219.32	18.81	218.32
SHL-8	PVC	221.85	7.07	214.78	R3	221.85	7.9	213.95
	PVC-2-INCH	221.66	?	221.66		221.66	7.02	214.64
SHL-9	PVC	222.86	16.7	206.16	8.1	214.76	9.38	213.48
SHL-10	PVC	248.80	31.05	217.75	30.61	218.19	31.3	217.5
SHL-11	PVC	236.34	18.89	217.45	18.66	217.68	18.91	217.43
SHL-12	PVC	249.51	22.79	226.72	22.62	226.89	23.02	226.49
SHL-13	PVC	221.58	7.03	214.55	6.46	215.12	7.21	214.37
SHL-15	PVC	260.75	18.4	242.35	16.62	244.13	18.03	242.72
SHL-17	PVC	234.57	7.97	226.6	7.81	226.76	8.22	226.35
SHL-18	PVC	238.39	19.35	219.04	18.94	219.45	19.81	218.58
SHL-19	PVC	241.34	22.95	218.39	22.72	218.62	23.31	218.03
SHL-20	PVC	236.84	19.28	217.56	19.05	217.79	19.32	217.52
SHL-21	PVC	259.75	45.27	214.48	44.55	215.2	45.52	214.23
SHL-22	PVC	220.49	7.57	212.92	5.88	214.61	7.06	213.43
SHL-23	PVC	242.14	27.4	214.74	26	216.14	27.67	214.47
SHL-24	PVC	239.60	16.14	223.46	15.85	223.75	16.53	223.07
SHL-25	PVC	258.87	25.68	233.19	22.74	236.13	25.23	233.64
SHM-93-01A	PVC	243.22	22.06	221.16	21.46	221.76	22.69	220.53
SHM-93-10C	PVC	248.42	30.16	218.26	29.8	218.62	30.47	217.95
SHM-93-18B	PVC	238.12	19.02	219.1	17.61	220.51	19.5	218.62
SHM-93-22C	PVC	221.55	7.83	213.72	6.99	214.56	8.14	213.41
SHM-93-24A	PVC	239.25	16.6	222.65	16.25	223	16.97	222.28
SHP-93-10D	CASING	248.48	Not Installed	Not Installed	33.5	214.98	30.99	217.49
SHP-93-10E	CASING	247.91	Not Installed	Not Installed	29.96	217.95	30.2	217.71
RHM-94-01X	PVC	220.74	Not Installed	Not Installed	3.59	217.15	3.77	216.97
RHM-94-02X	PVC	236.13	Not Installed	Not Installed	18.19	217.94	18.71	217.42
POL-1	PVC	259.77	19.33	240.44	18.02	241.75	19.21	240.56
POL-2	PVC	259.42	28.76	230.66	28.34	231.08	28.73	230.69
POL-3	PVC	261.94	25.87	236.07	23.97	237.97	25.86	236.08
32M-92-01X	PVC	258.68	Not Measured	Not Measured	15.98	242.7	17.74	240.94
32M-92-02X	PVC	262.61	Not Measured	Not Measured	20.48	242.13	21.83	240.78
32M-92-03X	PVC	260.72	Not Measured	Not Measured	27.73	232.99	28.6	232.12
32M-92-04X	PVC	261.37	Not Measured	Not Measured	Not Measured	Not Measured	12.23	249.14
32M-92-05X	PVC	260.55	Not Measured	Not Measured	Not Measured	Not Measured	16.23	244.32
32M-92-06X	PVC	262.89	Not Measured	Not Measured	9.45	253.44	12.96	249.93
32M-92-07X	PVC	259.63	Not Measured	Not Measured	13.16	246.47	14.15	245.48
43MA93-04X	PVC	261.37	28.72	232.65	28.15	233.22	28.66	232.71
43MA93-05X	PVC	260.55	31.7	228.85	31.38	229.17	31.58	228.97
43MA93-06X	PVC	262.89	31.36	231.53	31.18	231.71	31.3	231.59
43MA93-07X	PVC	259.63	28.19	231.44	0	Not Measured	28.1	231.53
43MA93-08X	PVC	260.29	28.2	232.09	27.6	232.69	28.09	232.2
43MA93-10X	PVC	260.41	Not Measured	Not Measured	27.52	232.89	27.89	232.52
B202-1	PVC	254.43	27.77	226.66	27.65	226.78	28.04	226.39
B202-2	PVC	258.37	31.5	226.87	31.41	226.96	Not Measured	258.37
B202-3	PVC	258.32	30.74	227.58	30.71	227.61	30.97	227.35
SWEL-04	TOP OF STAKE	218.00	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured

SYNOPTIC WATER-LEVEL MEASUREMENTS

FORT DEVENS

STATION/	REF. POINT	ELEV. OF REF. PT.	OCTOBER 4, 1994		JANUARY 31, 1995		MAY, 1995	
			DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	ELEV. OF WATER	DEPTH TO WATER	WATER
SWEL-PSP(P)	TOP OF STAKE	221.35	4.48	216.87	4.26	217.09	4.54	216.81
G3M-92-05X	PVC	254.30	29.27	225.03	29.15	225.15	29.44	224.86
GRM-01A	PVC	253.31	32.05	221.26	31.82	221.49	Not Measured	253.31
GRM-01B	PVC	252.9	33.63	219.27	33.36	219.54	Not Measured	252.9
GRM-01C	PVC	253.48	34.2	219.28	33.94	219.54	Not Measured	253.48

FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS
CONSOLIDATION LANDFILL FEASIBILITY STUDY
FORT DEVENS, MA

WELL	TEST TYPE	TYPE OF WELL	HYDRAULIC CONDUCTIVITY		TRANSMISSIVITY CM ² /SEC	SOURCE ¹⁻⁴
			BOUWER AND RICE ¹ CM/SEC	HVORSLEV ² CM/SEC		
SHL-5	RISING	OVERBURDEN	1E-02	NOT CALC.	3E00	E+E
	FALLING	OVERBURDEN	1E-02	NOT CALC.	3E00	E+E
SHL-7	RISING	OVERBURDEN	1E-02	NOT CALC.	2E00	E+E
	FALLING	OVERBURDEN	1E-03	NOT CALC.	2E-01	E+E
SHL-8S	RISING	OVERBURDEN	6E-03	NOT CALC.	8E-01	E+E
	FALLING	OVERBURDEN	7E-04	NOT CALC.	1E00	E+E
SHL-8D	RISING	OVERBURDEN	2E-03	NOT CALC.	3E00	E+E
	FALLING	OVERBURDEN	3E-03	NOT CALC.	4E00	E+E
SHL-9	RISING	OVERBURDEN	9E-03	NOT CALC.	4E00	E+E
	FALLING	OVERBURDEN	4E-03	NOT CALC.	2E00	E+E
SHL-10	RISING	OVERBURDEN	4E-03	NOT CALC.	6E-01	E+E
	FALLING	OVERBURDEN	2E-03	NOT CALC.	3E-01	E+E
SHL-11	RISING	OVERBURDEN	2E-04	NOT CALC.	5E-02	E+E
	FALLING	OVERBURDEN	4E-04	NOT CALC.	1E-01	E+E
SHL-12	RISING	OVERBURDEN	1E-02	NOT CALC.	2E00	E+E
	FALLING	OVERBURDEN	1E-02	NOT CALC.	2E00	E+E
SHL-13	RISING	OVERBURDEN	4E-03	NOT CALC.	2E00	E+E
	FALLING	OVERBURDEN	5E-04	NOT CALC.	2E-01	E+E
SHL-15	RISING	OVERBURDEN	8E-03	NOT CALC.	2E00	E+E
	FALLING	OVERBURDEN	2E-02	NOT CALC.	5E00	E+E
SHL-17	RISING	OVERBURDEN	3E-03	NOT CALC.	9E-01	E+E
	FALLING	OVERBURDEN	9E-02	NOT CALC.	3E01	E+E
SH-18	RISING	OVERBURDEN	1E-02	NOT CALC.	4E00	E+E
	FALLING	OVERBURDEN	4E-02	NOT CALC.	9E-01	E+E
SHL-19	RISING	OVERBURDEN	1E-01	NOT CALC.	3E01	E+E
	FALLING	OVERBURDEN	1E-03	NOT CALC.	4E-01	E+E
SHL-20	RISING	DRCK/OVRBRD	3E-02	NOT CALC.	3E01	E+E
SHL-21	RISING	OVERBURDEN	1E-02	NOT CALC.	3E00	E+E
	FALLING	OVERBURDEN	8E-03	NOT CALC.	2E00	E+E
SHL-22	UNKOWN	OVERBURDEN	2E-04	NOT CALC.	UNKNOWN	E+E
SHL-24	UNKOWN	DRCK/OVRBRD	1E-08	NOT CALC.	4E-05	E+E
SHL-25	UNKOWN	OVERBURDEN	9E-05	NOT CALC.	3E-01	E+E
POL-1	RISING	UNKNOWN	3E-04	NOT CALC.	9E-03	E+E
	FALLING	UNKNOWN	3E-04	NOT CALC.	1E-02	E+E
POL-3	RISING	UNKNOWN	5E-04	NOT CALC.	8E-02	E+E
	FALLING	UNKNOWN	8E-04	NOT CALC.	1E-01	E+E
B202-1	FALLING	UNKNOWN	6E-02	NOT CALC.	2E01	E+E
B202-2	RISING	UNKNOWN	2E-02	NOT CALC.	4E00	E+E
	FALLING	UNKNOWN	1E-02	NOT CALC.	3E00	E+E
B202-3	RISING	UNKNOWN	3E-02	NOT CALC.	1E01	E+E
	FALLING	UNKNOWN	5E-02	NOT CALC.	1E01	E+E
SHM-93-01A	RISING	OVERBURDEN	4E-03	1E-03	NOT CALC.	ABB-ES
	RISING	OVERBURDEN	9E-03	1E-03	NOT CALC.	ABB-ES
SHM-93-10C	RISING	BEDROCK	2E-04	3E-05	NOT CALC.	ABB-ES
	FALLING	BEDROCK	2E-04	3E-05	NOT CALC.	ABB-ES
SHM-93-18B	RISING	OVERBURDEN	4E-03	5E-04	NOT CALC.	ABB-ES
	RISING	OVERBURDEN	4E-03	5E-04	NOT CALC.	ABB-ES
SHM-93-22C	RISING	BEDROCK	6E-06	5E-07	NOT CALC.	ABB-ES
SHM-93-24A	RISING	OVERBURDEN	2E-02	2E-02	NOT CALC.	ABB-ES
	RISING	OVERBURDEN	4E-02	2E-02	NOT CALC.	ABB-ES
		Maximum	1E-01	2E-02	34.54	
		Minimum	1E-08	5E-07	4E-05	
		Average	1E-02	5E-03	5E00	
		Geometric Mean	3E-03	3E-04	1E00	
		Standard Deviation	2E-02	9E-03	8E00	

NOTES:

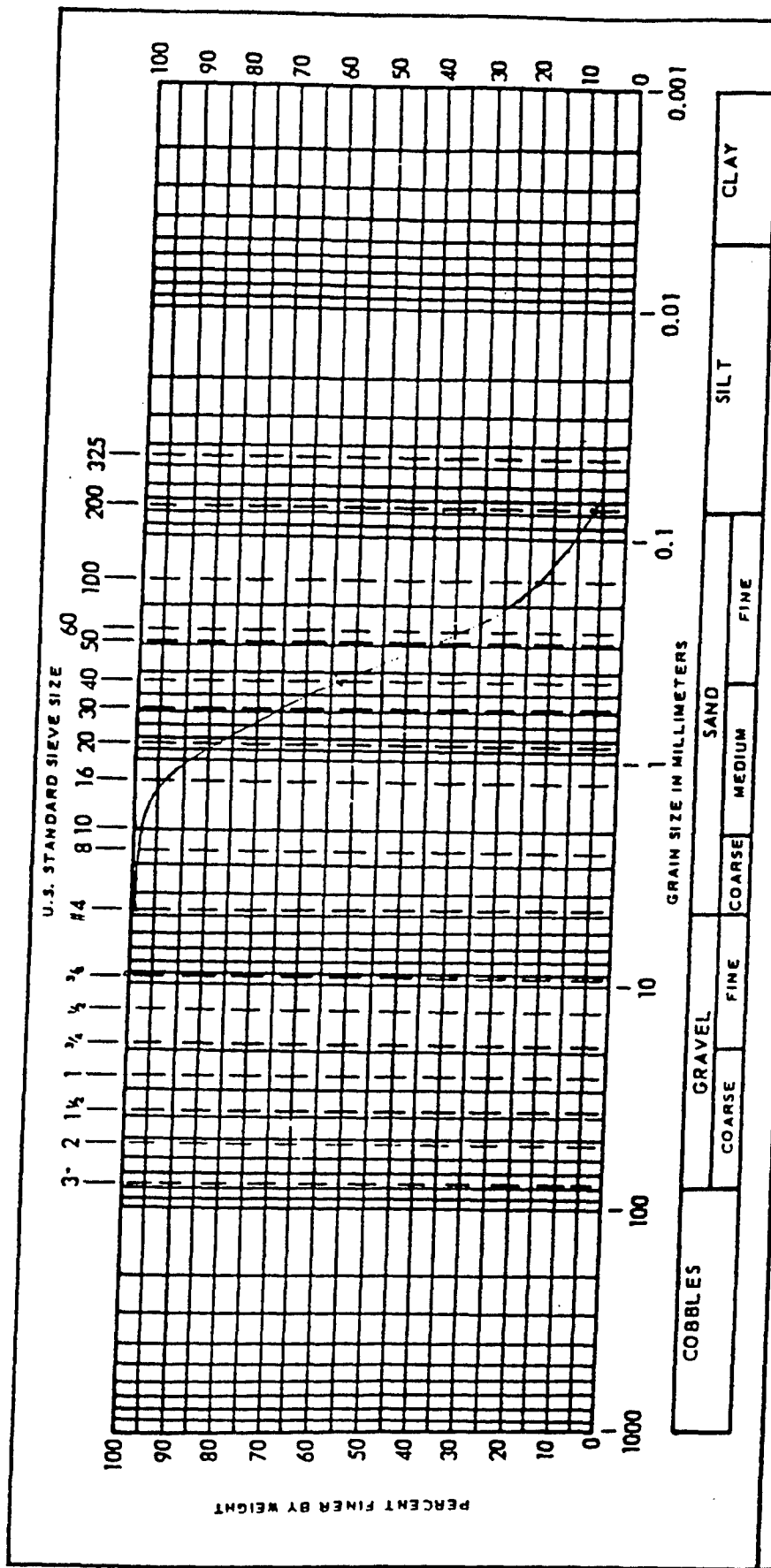
- 1 - Bouwer and Rice (1976)
- 2 - Hvorslev (1951)
- 3 - E + E (Ecology and Environment, Inc.) Draft Final Remedial Investigation Report, 1992
- 4 - ABB-ES Final Remedial Investigation Addendum Report, 1993

SOIL CLASSIFICATION SHEET

U.S. STANDARD SIEVE SIZE		GRAIN SIZE IN MILLIMETERS									
3" 2 1 1/2 1 3/4 1/2 3/8 1/4 3/16 1/8 1/16 1/32		1000 100 10 1 0.1 0.01 0.001									
PERCENT FINER BY WEIGHT											
		COBBLES		GRAVEL		SAND		SILT		CLAY	
		COARSE FINE		COARSE MEDIUM FINE							
PROJECT Fort Devens/USATHAMA Project No. UC 2061		NATURAL & MOISTURE LIQUID LIMIT PLASTIC LIMIT PLASTICITY INDEX COLOR REMARKS T.T.L. Job No. CM-13551									
BORING NO. SAMPLE NO. SHL-25 DEPTH CLASSIFICATION											

Toledo Testing Laboratory, Inc.

SOIL CLASSIFICATION SHEET



PROJECT Fort Devens/USATHAMA
Project No. UC 2061

BORING NO.

SAMPLE NO. SHL-23

DEPTH

CLASSIFICATION

NATURAL & MOISTURE

LIQUID LIMIT

PLASTIC LIMIT

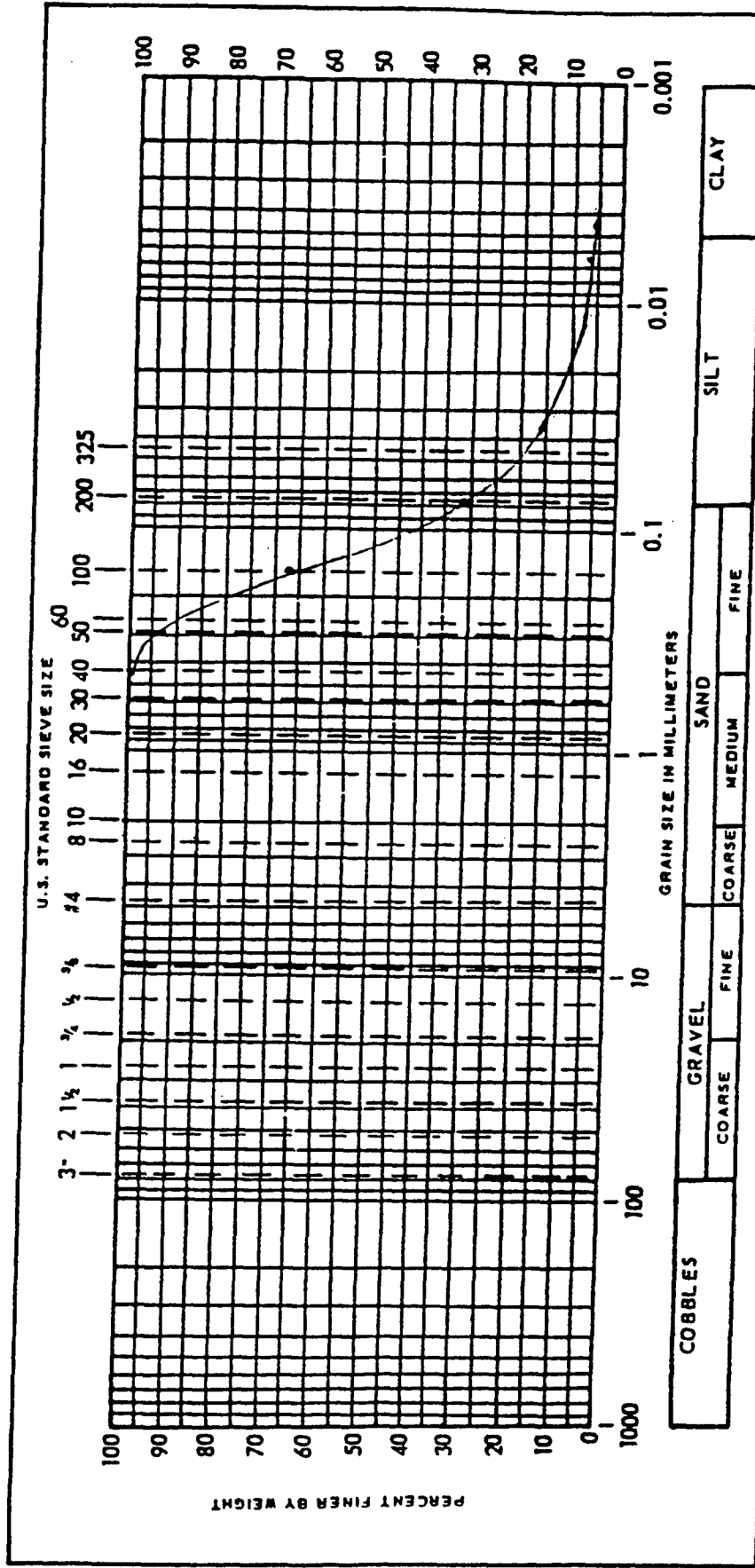
PLASTICITY INDEX

COLOR

REMARKS T.T.L. Job No. CM-13551

Toledo Testing Laboratory, Inc.

SOIL CLASSIFICATION SHEET



PROJECT Fort Devens/USATHAMA
Project No. UC 2061

BORING NO.

SAMPLE NO. SHL-21

DEPTH

CLASSIFICATION

NATURAL & MOISTURE

LIQUID LIMIT

PLASTIC LIMIT

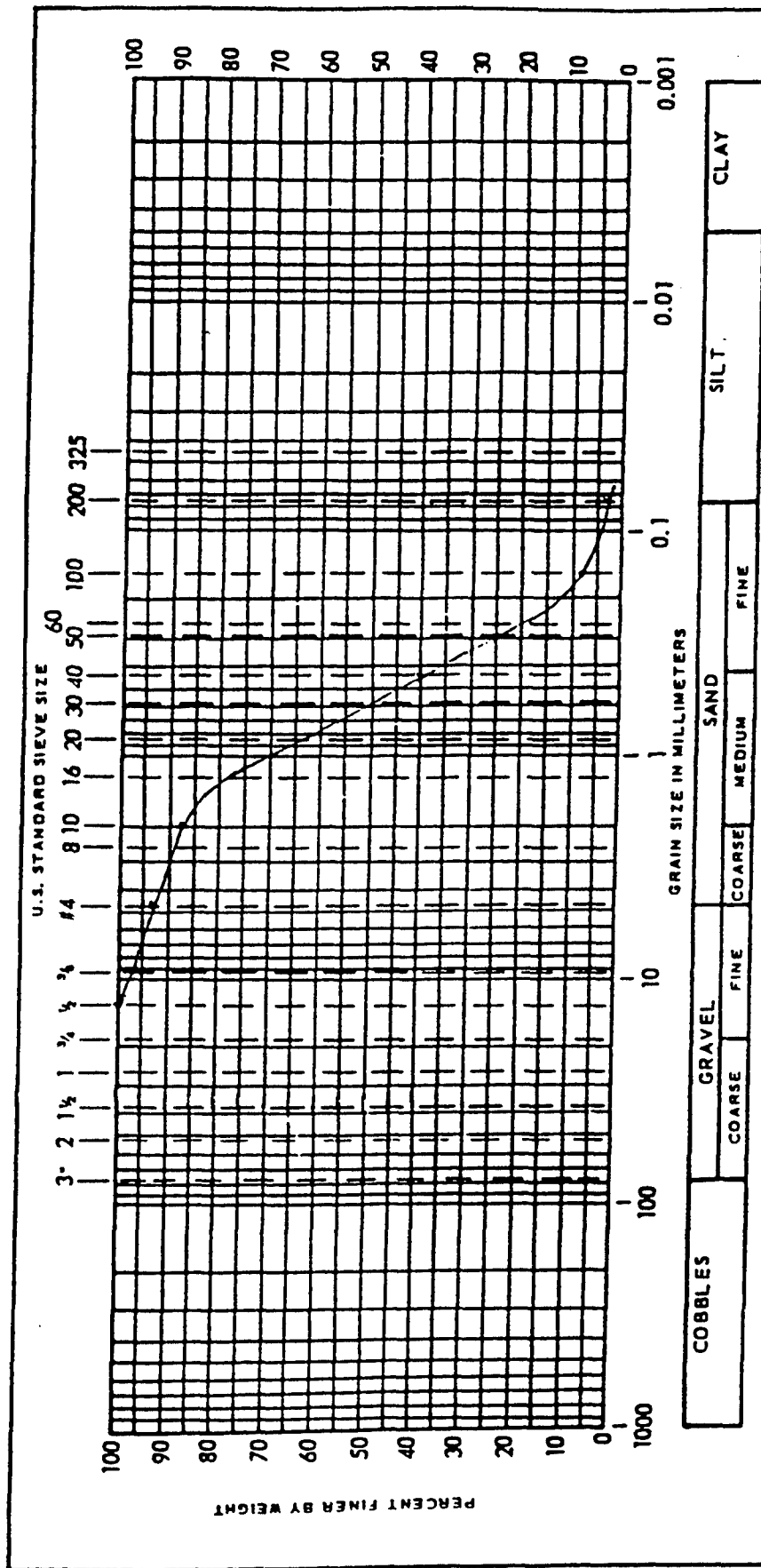
PLASTICITY INDEX

COLOR

REMARKS T.T.L. Job No. CM-13551

Toledo Testing Laboratory, Inc.

SOIL CLASSIFICATION SHEET



PROJECT Fort Devens/USATHAMA
Project No. UC 2061

BORING NO.

SAMPLE NO. SHL-14B

DEPTH

CLASSIFICATION

NATURAL & MOISTURE

LIQUID LIMIT

PLASTIC LIMIT

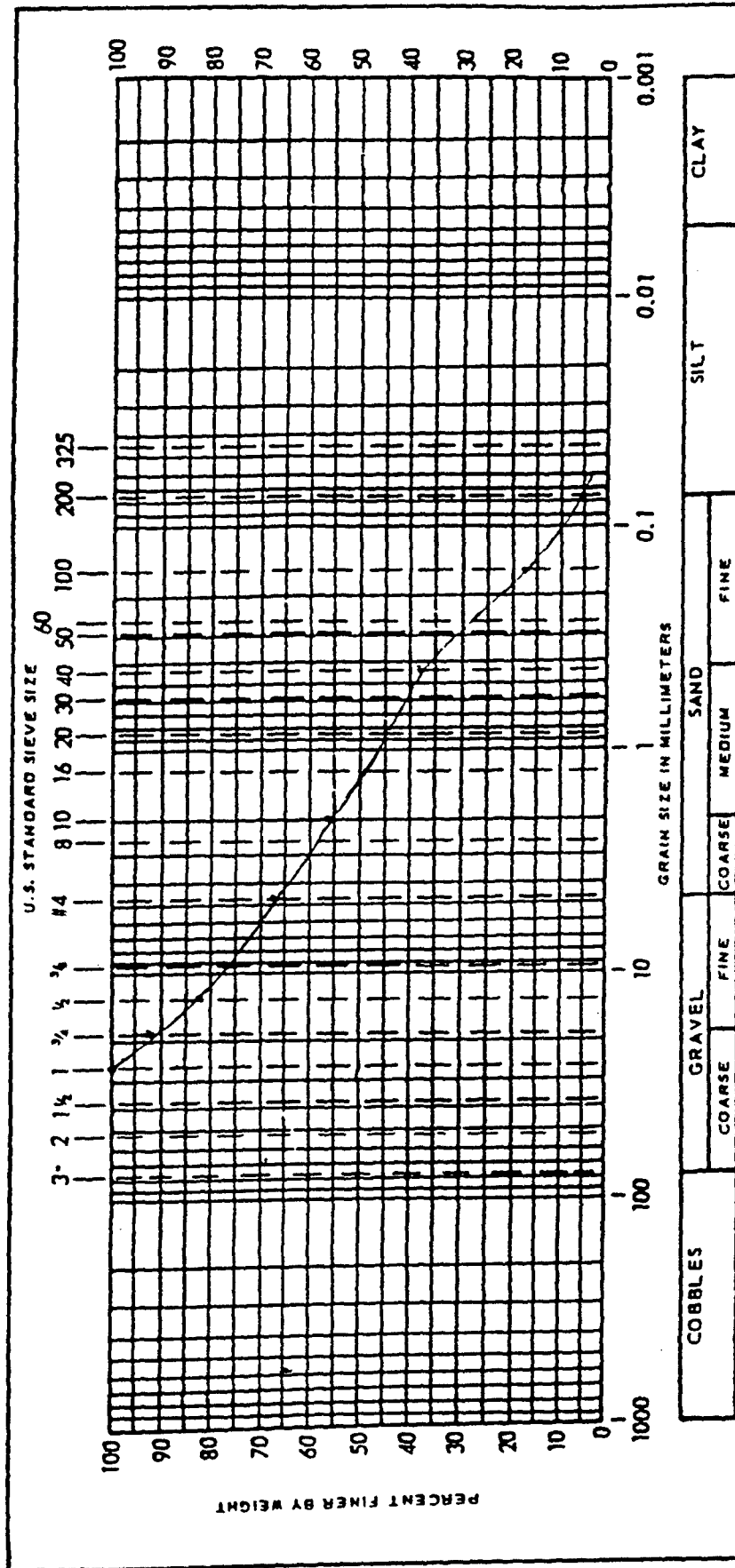
PLASTICITY INDEX

COLOR

REMARKS T.T.L. Job No. CM-13551

Toledo Testing Laboratory, Inc.

SOIL CLASSIFICATION SHEET



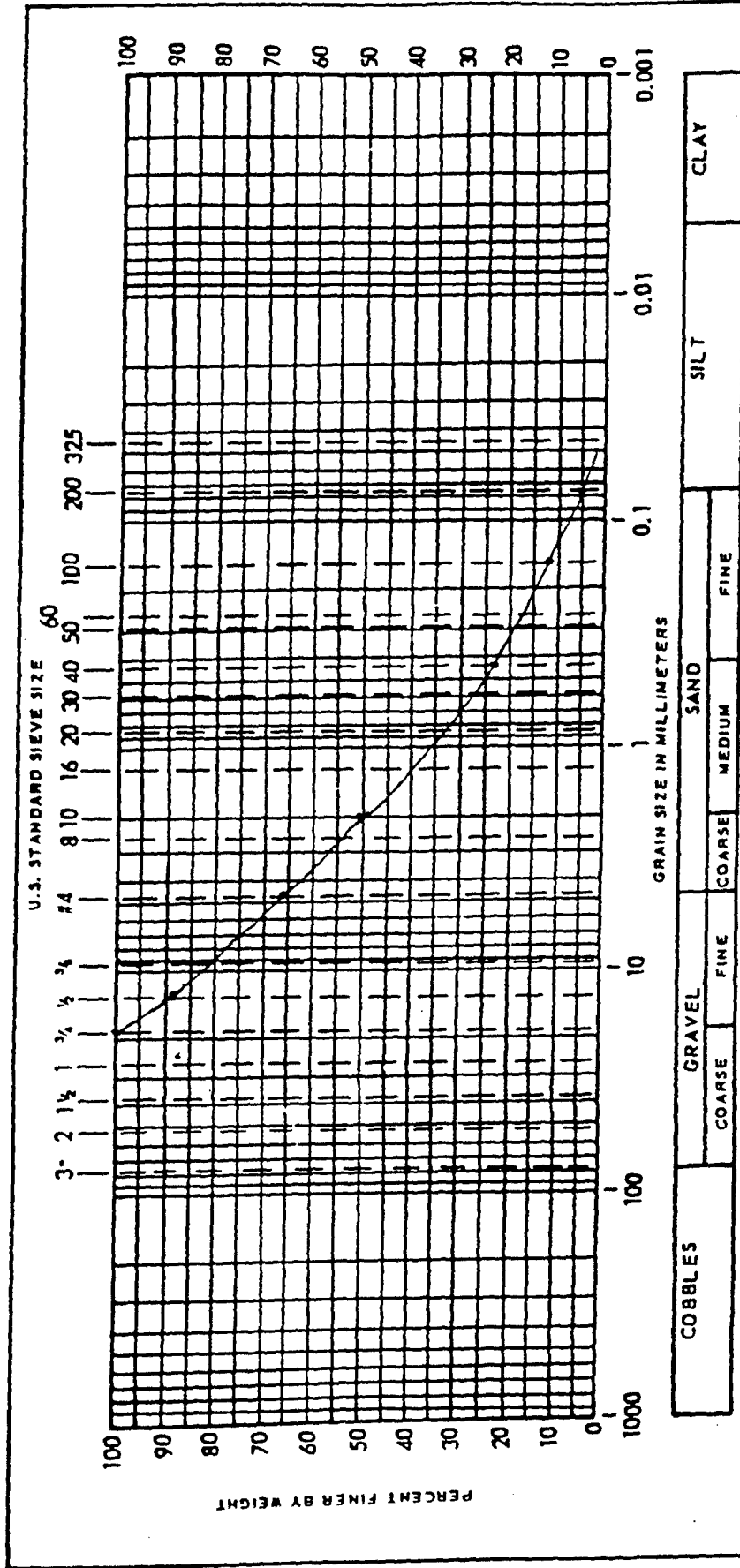
PROJECT Fort Devens/USATHAMA
Project No. UC 2061

BORING NO. SHL-15
SAMPLE NO.
DEPTH
CLASSIFICATION

NATURAL % MOISTURE
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX
COLOR
REMARKS T.T.L. Job No. CM-13551

Toledo Testing Laboratory, Inc.

SOIL CLASSIFICATION SHEET



PROJECT Fort Devens/USATHAMA
Project No. UC 2061

BORING NO.
SAMPLE NO. SHL-22
DEPTH
CLASSIFICATION

NATURAL % MOISTURE
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX
COLOR

REMARKS T.I.L. Job No. CM-13551

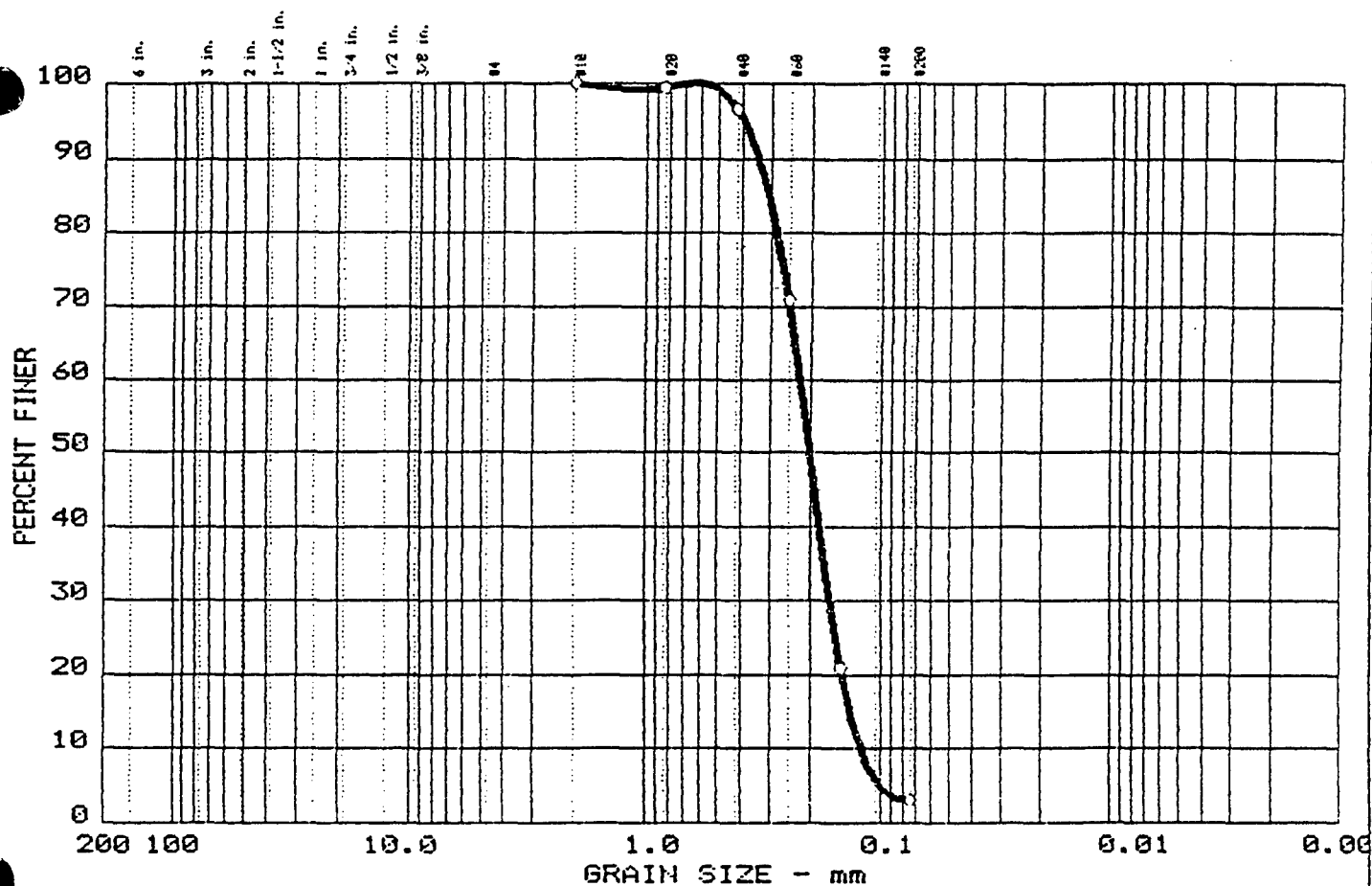
Toledo Testing Laboratory, Inc.

SOIL CLASSIFICATION SHEET

U.S. STANDARD SIEVE SIZE		GRAIN SIZE IN MILLIMETERS										
3"	2 1/2"	1 1/2"	3/4"	3/8"	#4	#10	#20	#40	#60	100	200	325
COBBLES		GRAVEL		SAND		SILT		CLAY				
COARSE		FINE		COARSE		MEDIUM		FINE				

PROJECT Fort Devens/USATHAMA Project No. UC 2061 BORING NO. SAMPLE NO. SHL-24 DEPTH CLASSIFICATION	NATURAL % MOISTURE LIQUID LIMIT PLASTIC LIMIT PLASTICITY INDEX COLOR REMARKS T.T.L. Job No. CM-13551	Toledo Testing Laboratory, Inc.
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GRAIN SIZE DISTRIBUTION TEST REPORT



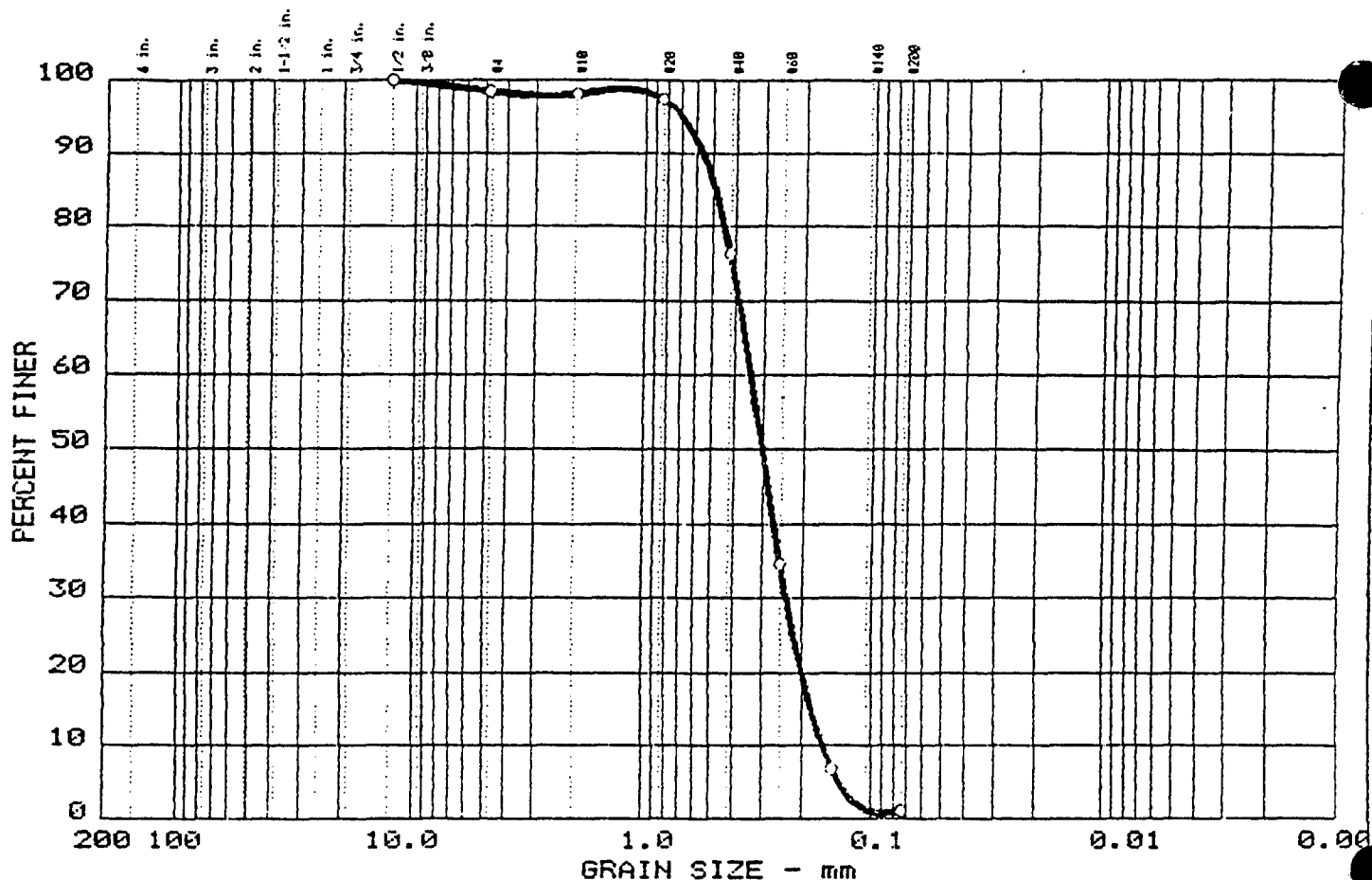
% +3"	% GRAVEL	% SAND	% FINES
0.0	0.0	96.9	3.1

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
--	--	0.31	0.22	0.20	0.166	0.1361	0.1226	1.01	1.8

MATERIAL DESCRIPTION	USCS	AASHTO
○ Poorly Graded SAND	SP	--

Project No.: 7005-04 Project: USATHAMA - Fort Devens: Group 1A ○ Location: Site ID - SHB-93-01A Date: March 25, 1993	Remarks: Sample ID SHB-93-012 Depth 5'-7'/10'-12' As rec'd w% = 6.8
GRAIN SIZE DISTRIBUTION TEST REPORT CIVILTEST LABORATORIES, INC.	
CT - 1493	

GRAIN SIZE DISTRIBUTION TEST REPORT



% +3"	% GRAVEL	% SAND	% FINES
0.0	1.5	97.4	1.1

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
--	--	0.49	0.34	0.30	0.235	0.1828	0.1629	1.00	2.1

MATERIAL DESCRIPTION	USCS	AASHTO
○ Poorly Graded SAND	SP	--

Project No.: 7005-04
 Project: USATHAMA - Fort Devens: Group 1A
 ○ Location: Site ID - SHB-93-24A

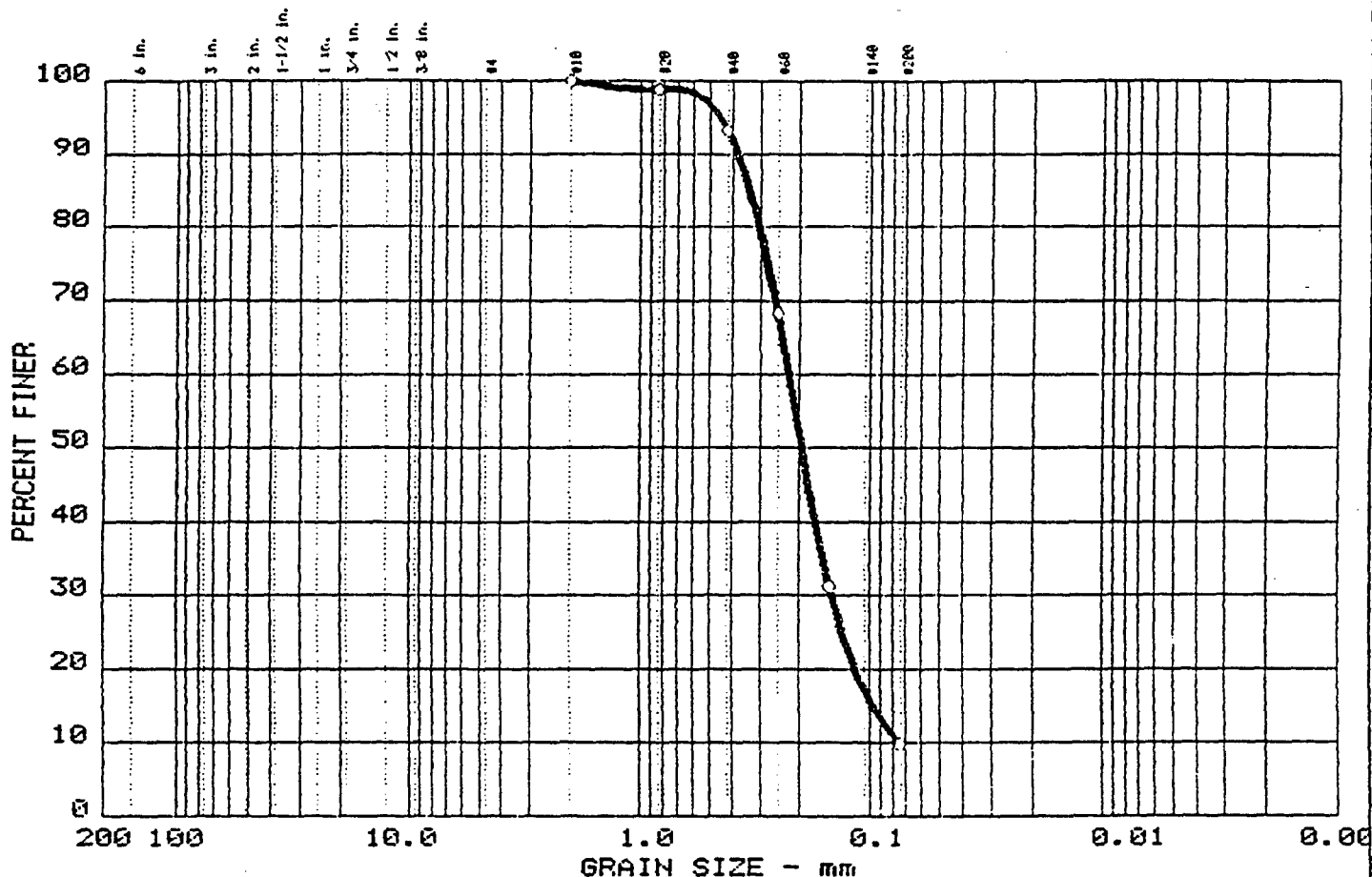
Date: March 25, 1993

Remarks:
 Sample ID SHB-93-022
 Depth 20.0'-22.0'
 As rec'd w% = 24.9

GRAIN SIZE DISTRIBUTION TEST REPORT
 CIVILTEST LABORATORIES, INC.

CT - 1493

GRAIN SIZE DISTRIBUTION TEST REPORT



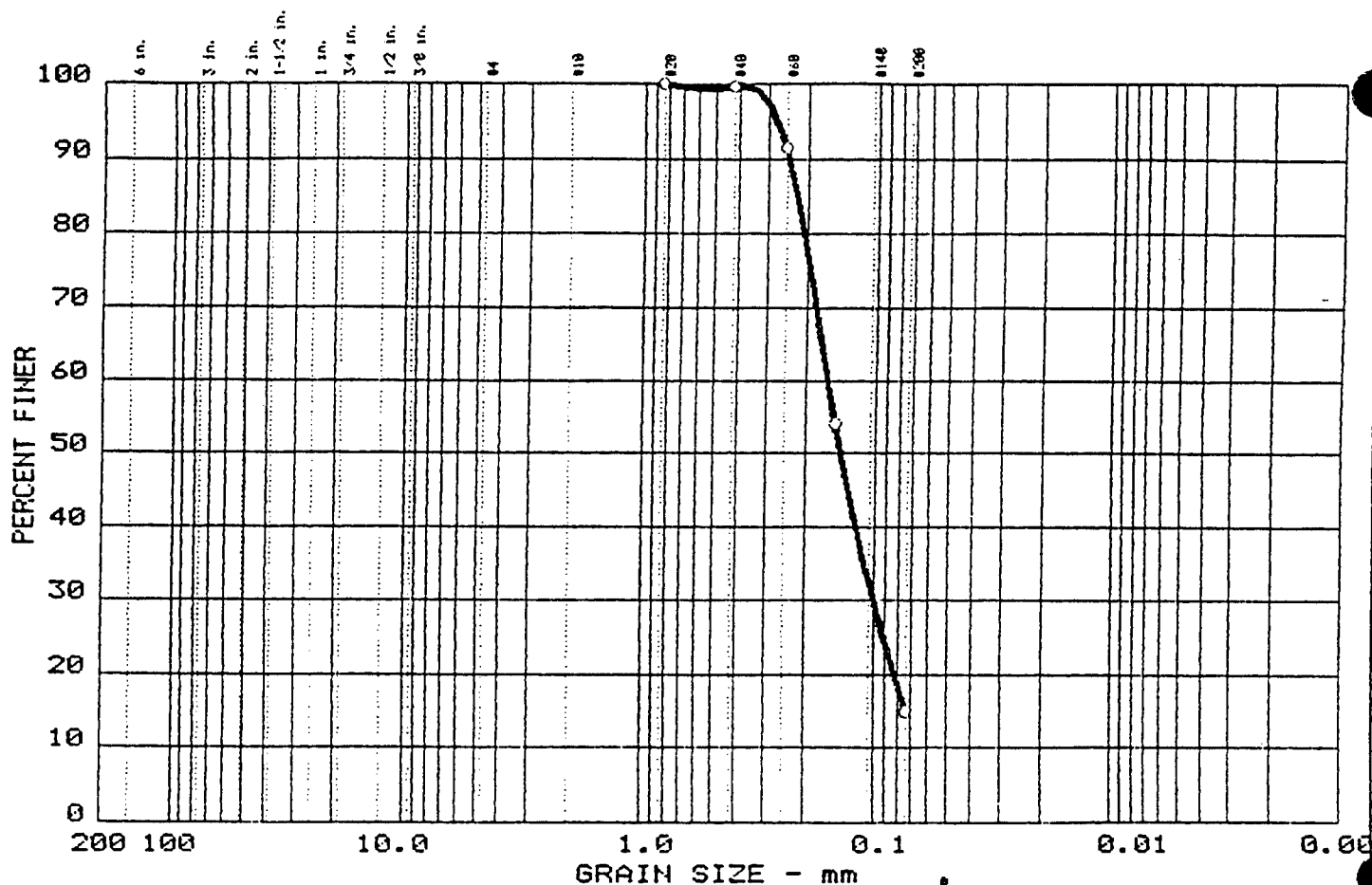
% +3"	% GRAVEL	% SAND	% FINES
0.0	0.0	90.1	9.9

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
--	--	0.33	0.22	0.20	0.146	0.0963			

MATERIAL DESCRIPTION	USCS	AASHTO
○ Poorly Graded SAND with Silt	SP-SM	--

<p>Project No.: 7005-04 Project: USATHAMA - Fort Devens: Group 1A ○ Location: Site ID - SHB-93-18B</p> <p>Date: March 25, 1993</p>	<p>Remarks: Sample ID SHB-93-037 Depth 35.0'-37.0' As rec'd w% = 20.0</p>
GRAIN SIZE DISTRIBUTION TEST REPORT CIVILTEST LABORATORIES, INC.	
CT - 1493	

GRAIN SIZE DISTRIBUTION TEST REPORT



% +3"	% GRAVEL	% SAND	% FINES
0.0	0.0	85.0	15.0

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
--	--	0.22	0.16	0.14	0.101				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT with Sand (based on grain-size)	SM	--

Project No.: 7005-04
 Project: USATHAMA - Fort Devens: Group 1A
 ○ Location: Site ID - SHB-93-18B

 Date: March 25, 1993

Remarks:
 Sample ID SHB-93-085
 Depth 83.0'-85.0'
 As rec'd w% = 21.9

GRAIN SIZE DISTRIBUTION TEST REPORT
 CIVILTEST LABORATORIES, INC.

CT - 1493



SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger & NX Core Barrel

SEA GEOLOGIST/ENGINEER: M. Gitten

MONITORING WELL NO. BAR-1
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: Ft. Devens Landfill
DATE
START: 1/28/86 FINISH: 1/30/86

BARCAD SAMPLER
No. 1

GROUNDWATER DEPTH : 12.55'

DATE : 3/7/86

DATUM : Casing

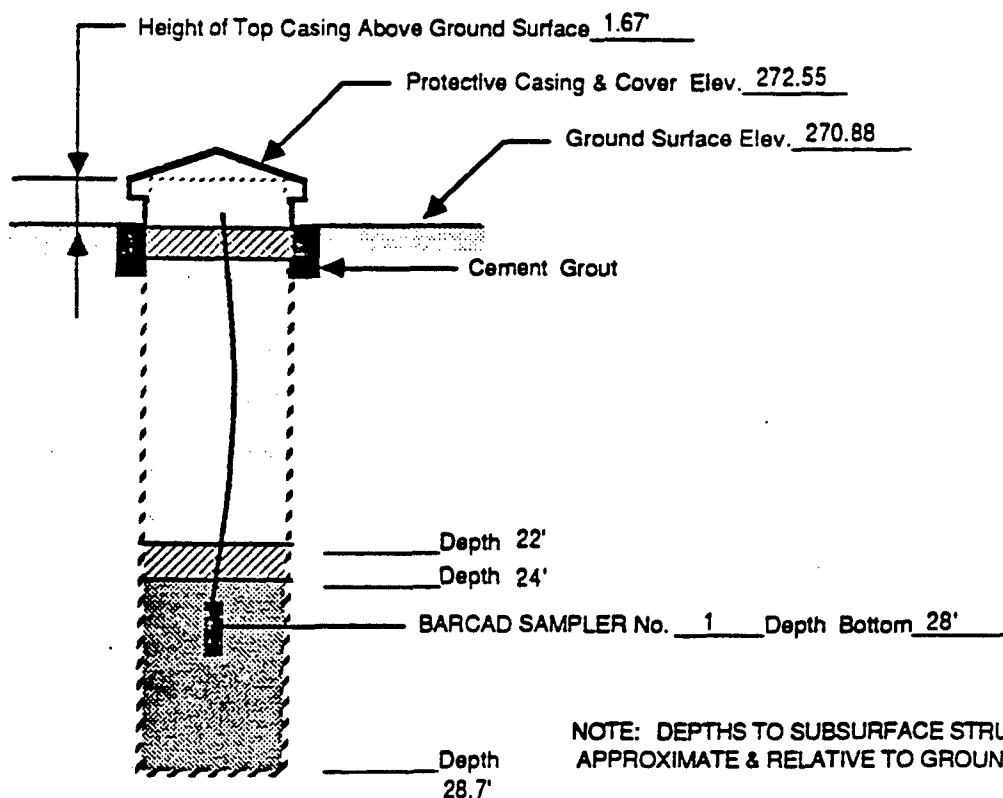
SOIL SAMPLES TAKEN: Yes

EQUIPMENT CLEANING: Yes

METHOD: Steam and methanol rinse

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water

LEGEND



MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION



SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger

SEA GEOLOGIST/ENGINEER: M. Gitten

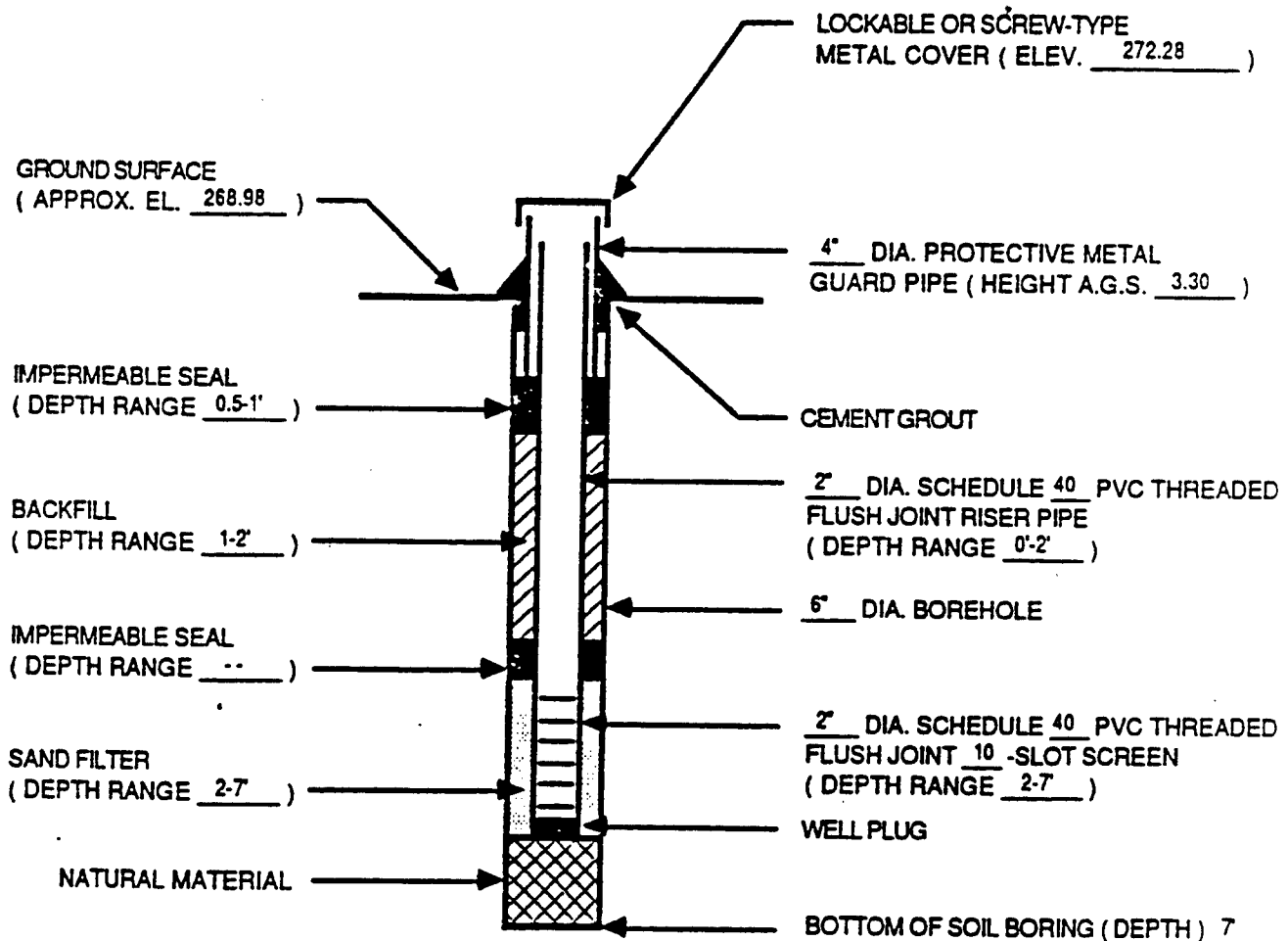
GROUNDWATER LEVEL:
DATE: 2/27/86
TIME: _____
FEET: 6'
METHOD: Tape
DATUM: G.S.

MONITORING WELL NO. WT-1
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: Ft. Devens Landfill
DATE
START: 1/31/86 FINISH: 2/27/86

SOIL SAMPLES TAKEN: No

EQUIPMENT CLEANING: No
METHOD: _____

MATERIAL TO FACILITATE DRILLING: No
TYPE: _____



MONITORING WELL
CROSS SECTION SCHEMATIC



**Project : Barson's Construction
Landfill Closure
Ft. Devens**

Boring Log

Boring No. SEA-1
Ref. No. 392-8511

Contractor : Soil Exploration Corp **Date:** 28 Jan. 86

Engineer/Geologist : M. Gitten

Boring Location : See Site Plan

Ground Surface Elev.: 270.88

Water Level : 12.6'

Date : 7 March 86

Casing Size : 3-1/4" I.D. Hollow Stem

Sampler : 1-3/8" I.D. Split Spoon +
NX Core Barrel

Casing at : 0

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
0.5	S-1	5/5	0-0.4'	100/5"	FILL: Brown, medium to coarse SAND		FILL: Medium to coarse SAND (SP)
1							
1.5							
2							
2.5							
3							
3.5							
4							
4.5	S-2	18/14	4-5.5	6			
5				6			
5.5				7			
6							
6.5							
7							
7.5	S-3	—	7-	—			
8							
8.5							
9							
9.5	S-4	18/0	9-10.5	13			
10				24			
10.5				17			
11							
11.5							
12							
12.5							
13							
13.5							
14							
14.5	S-5	8/6	14-14.7	60			
15				80/2"			
15.5							
16							
16.5							
17							
17.5							
18							
18.5	S-6	2/2	18-18.2	100/2"			
19							
19.5							
20							

					Brown, fine SAND, some silt and coarse gravel (glacial till)	(1)	(6.5') FILL: Landfill refuse
					Brown, fine SAND, some silt and coarse gravel (glacial till)		(13.0') Fine SAND, some silt and coarse gravel (SM)

Granular Soils		Cohesive Soils	
Blows/Ft.	Density	Blows/Ft.	Density
0-4	V. Loose	<2	V. Soft
4-10	Loose	2-4	Soft
10-30	M. Dense	4-8	M. Stiff
30-50	Dense	8-15	Stiff
>50	V. Dense	15-30	V. Stiff
		>30	Hard


Remarks:

- (1) Boring encountered refuse, unanticipated at this location
(2) All coring time in minutes

Boring Log

Boring No. SEA-1
Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Ft. Devens			Boring Log Boring No. SEA-1 Ref. No. 392-8511		
Contractor : Soil Exploration Corp Date: 23 Jan. 86 Engineer/Geologist : M. Gitten Boring Location : See Site Plan Ground Surface Elev. : 270.88 Water Level : 12.5' Date : 7 March 88 Casing at : 0					Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon + NX Core Barrel		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
20.5							Find SAND, some silt and coarse gravel (SM) (23.7') _____ Very hard to hard, light grey, fine-grained equigranular, gneissic biotite GRANITE (28.7') _____ Bottom of exploration at 28.7'
21							
21.5							
22							
22.5							
23							
23.5							
24	S-7	0/0	23.7	120/0"			
24.5							
25							
25.5	c-1	60/50	23.7-28.7	18			
26							
26.5		recovery	=83%	12			
27							
27.5				4			
28							
28.5				8			
29							
29.5				8			
30							
30.5							
31							
31.5							
32							
32.5							
33							
33.5							
34							
34.5							
35							
35.5							
36							
36.5							
37							
37.5							
38							
38.5							
39							
39.5							
40							

Granular Soils		Cohesive Soils		Remarks: (1) Boring encountered refuse, unanticipated at this location (2) All coring time in minutes
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-1
 Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



S E A Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: Stem Auger & NX Core Barrel

SEA GEOLOGIST/ENGINEER: M. Gitten

MONITORING WELL NO. BAR-2
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: Ft. Devens Landfill
DATE
START: 1/31/86 FINISH: 2/3/86

BARCAD SAMPLER
No. 1 No. 2

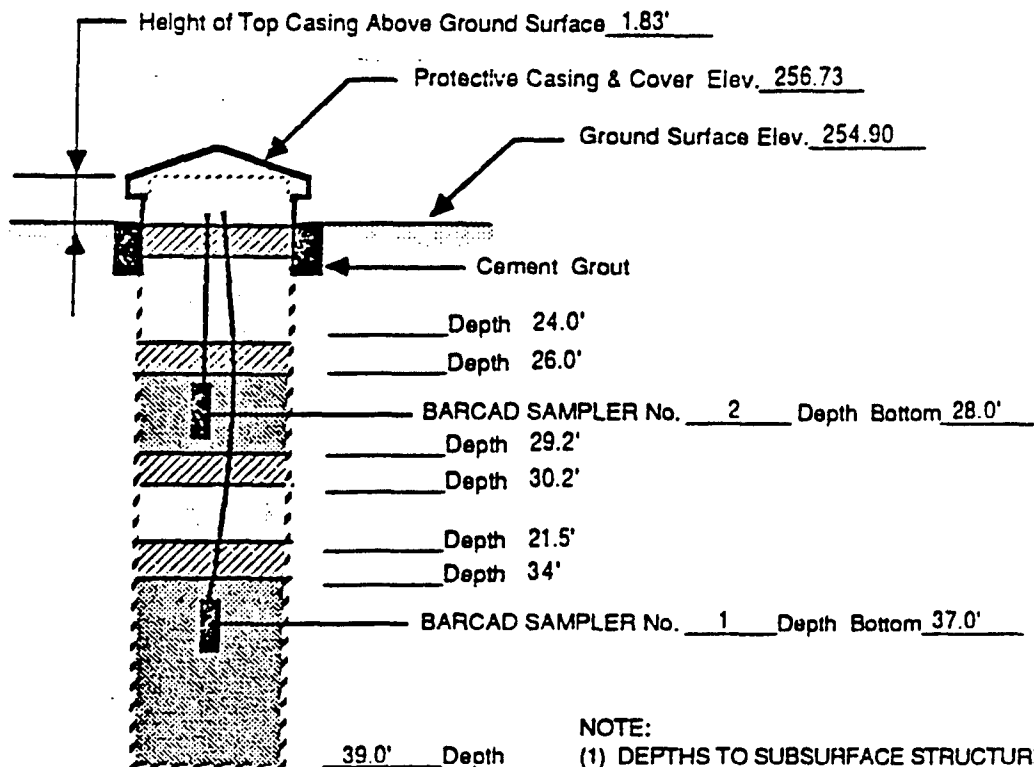
GROUNDWATER DEPTH : --- 24.15'
DATE : --- 3/7/86
DATUM : --- T.C.

SOIL SAMPLES TAKEN: Yes

EQUIPMENT CLEANING: Yes
METHOD: Steam and methanol rinse

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water

LEGEND



NOTE:

- (1) DEPTHS TO SUBSURFACE STRUCTURES ARE APPROXIMATE & RELATIVE TO GROUND SURFACE
- (2) AT COMPLETION BARCAD SAMPLER NO. 1 NOT OPERATIONAL RISER DAMAGED DURING WITHDRAWAL OF AUGERS.

MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION



SEA Consultants Inc.
Engineers/Architects

Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger /Nx Core Barrel

SEA GEOLOGIST/ENGINEER: M Schultz

MONITORING WELL NO. BAR-2A & WT-2

JOB NO: 392-8511 CLIENT: Barson's

LOCATION: Ft Devens Landfill

DATE

START: 1/31/86 FINISH: 2/3/86

BARCAD WELL
No. 1 WT-2

SOIL SAMPLES TAKEN: No

GROUNDWATER DEPTH: 21.8' 22.0'

DATE: 3/7/86 3/7/86

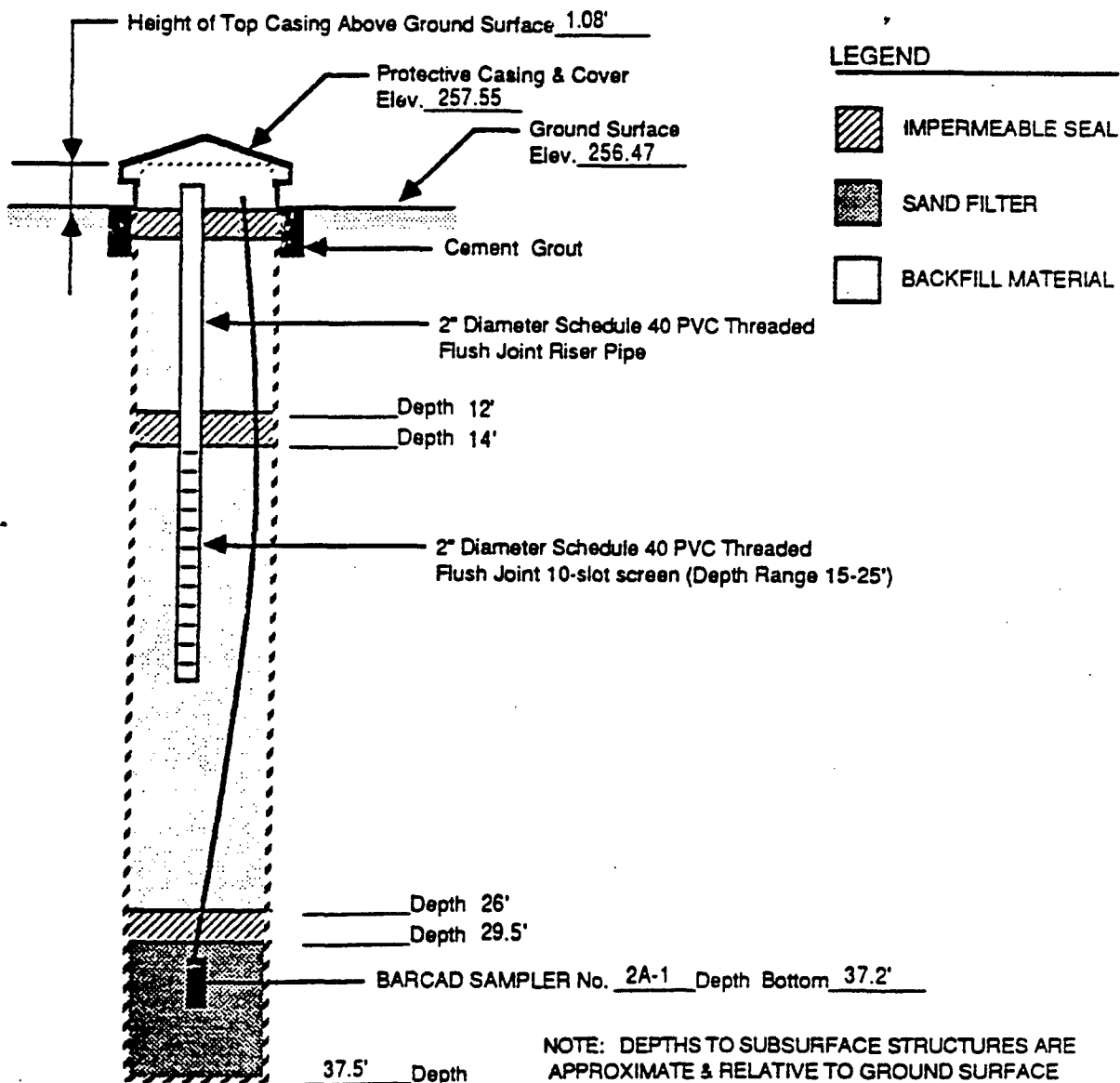
DATUM: T.C. T.C.

EQUIPMENT CLEANING: Yes


METHOD: Steam & Methanol Rinse

MATERIAL TO FACILITATE DRILLING: Yes

TYPE: Water




MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Ft. Devens				Boring Log Boring No. SEA-2 Ref. No. 392-8511	
Contractor : Soil Exploration Corp. Date: 31 Jan-3 Feb 86 Engineer/Geologist : M. Gitten Boring Location : See Site Plan Ground Surface Elev. : 254.90 Water Level : 19.5' Date : 3 Feb. 86 Casing at : 32'					Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon & NX Core Barrel		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) / Rec.	Depth (ft)	Blows/6"			
0.5	S-1	13/4	0-1.1	79	Brown, fine SAND, little coarse sand and fine gravel, trace inorganic silt with roots	(1)	Fine to medium SAND, little coarse sand and gravel (SP)
1				33			
1.5				50/1"			
2							
2.5							
3							
3.5							
4							
4.5	S-2	18/16	4-5.5	7	Brown, fine SAND, little medium to coarse sand and fine gravel		
5				13			
5.5				11			
6							
6.5							
7							
7.5							
8							
8.5							
9							
9.5	S-3	18/14	9-10.5	13	Brown, fine to medium SAND, little coarse sand and fine to medium gravel		
10				17			
10.5				20			
11							
11.5							
12							
12.5							
13							
13.5							
14							
14.5	S-4	18/15	14-15.5	10	Brown, fine SAND, little medium to coarse sand and fine gravel		
15				20			
15.5				23			
16							
16.5							
17							
17.5							
18							
18.5							
19							
19.5	S-5	18/18	19-20.5	12	Brown, fine SAND, trace inorganic silt		(18.0') Fine SAND, trace inorganic silt (SP)
				17			
20				16			

Granular Soils		Cohesive Soils		Remarks:
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	(1) Blow counts high for S-1 due to frost penetration. (2) Gravel pieces include both subangular and angular (rock fragments). (3) All coring times in minutes.
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-2
 Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Ft. Devens			Boring Log Boring No. SEA-2 Ref. No. 392-8511		
Contractor : Soil Exploration Corp. Date: 31 Jan-3 Feb 86 Engineer/Geologist : M. Gitten Boring Location : See Site Plan Ground Surface Elev. : 254.90 Water Level : 19.5' Date : 3 Feb. 86				Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon & NX Core Barrel Casing at : 32'			
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) / Rec.	Depth (ft)	Blows/6"			
20.5							Fine SAND, trace inorganic silt (SP)
21							
21.5							
22							
22.5							
23							(22.5) _____ Fine SAND, little inorganic silt with lenses of inorganic SILT (SM/ML)
23.5							
24							
24.5	S-6	18/18	24-25.5	17	Brown, fine to coarse SAND, little inorganic silt with lenses of SILT		
25				20			
25.5				28			
26							
26.5							
27							
27.5							
28							
28.5							
29						(2)	(28.0) _____ Fine to coarse SAND, little fine to coarse gravel, trace inorganic silt (SW)
29.5	S-7	18/12	29-30.5	18	Brown, fine to coarse SAND, little fine to coarse gravel, trace inorganic silt		
30				30			
30.5				28			
31							
31.5							
32							
32.5	S-8	0/0	32	100/0"			(32.0) _____
33				Coring Time	Fresh to slightly weathered biotite GRANODIORITE, with closely to medium spaced, tight, planar joints; joints are flat (0° to 20°) to steeply dipping (45° to 70°), few quartz stringers	(3)	Very hard to hard, dark grey, equiangular to slightly porphyritic biotite GRANODIORITE with few quartz stringers
33.5	C-1	60/55	32-37	10			
34							
34.5				8			
35		Recovery	= 92%				
35.5				9			
36							
36.5				11			
37							
37.5				8			
38							
38.5	C-2	24/22	37-39	12			
39							
39.5		Recovery	= 92%	12	Bottom of Exploration at 39'		(39.0) _____
40							

Granular Soils		Cohesive Soils		Remarks: (1) Blow counts high for S-1 due to frost penetration. (2) Gravel pieces include both subangular and angular (rock fragments). (3) All coring times in minutes.
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-2
 Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



SEA Consultants Inc.
Engineers/Architects
Cambridge, MA S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger & NX Core Barrel

SEA GEOLOGIST/ENGINEER: J. Jammallo

MONITORING WELL NO. BAR-3
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: FL Devens Landfill
DATE
START: 2/5/86 FINISH: 2/6/86

BARCAD SAMPLER
No. 1

GROUNDWATER DEPTH : 29.5'

DATE : 2/16/86

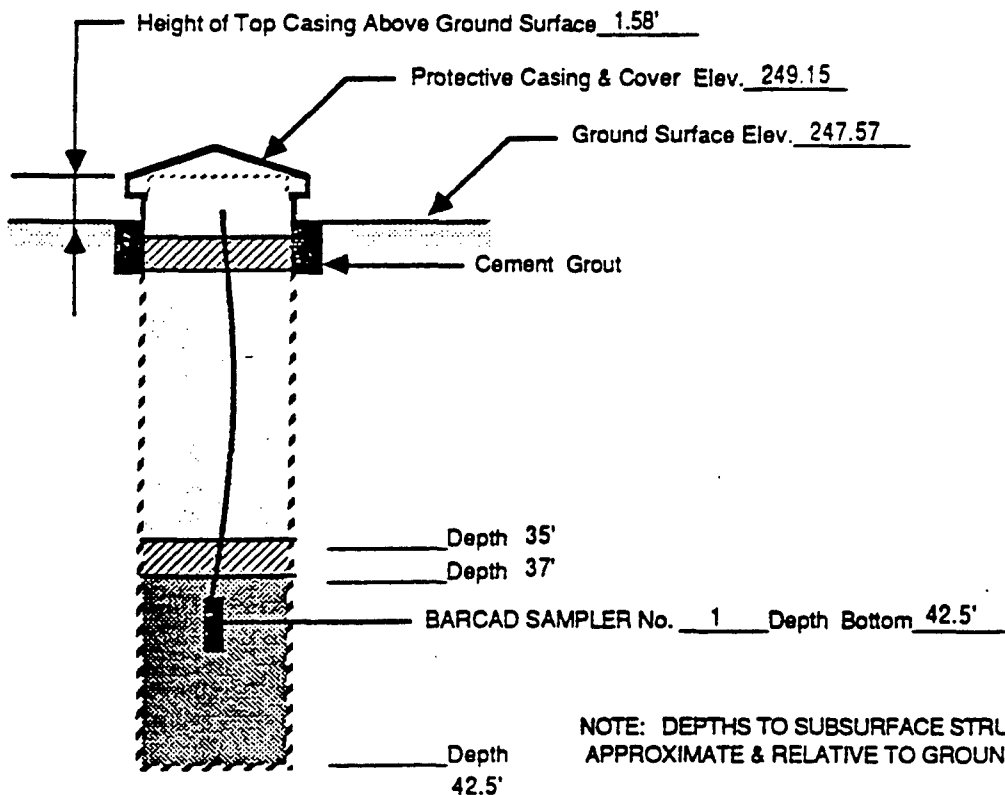
DATUM : G.S.

SOIL SAMPLES TAKEN: Yes

EQUIPMENT CLEANING: Yes
METHOD: Steam clean and methanol rinse

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water

LEGEND



NOTE: DEPTHS TO SUBSURFACE STRUCTURES ARE APPROXIMATE & RELATIVE TO GROUND SURFACE

MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION



SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger

SEA GEOLOGIST/ENGINEER: J. Jammallo

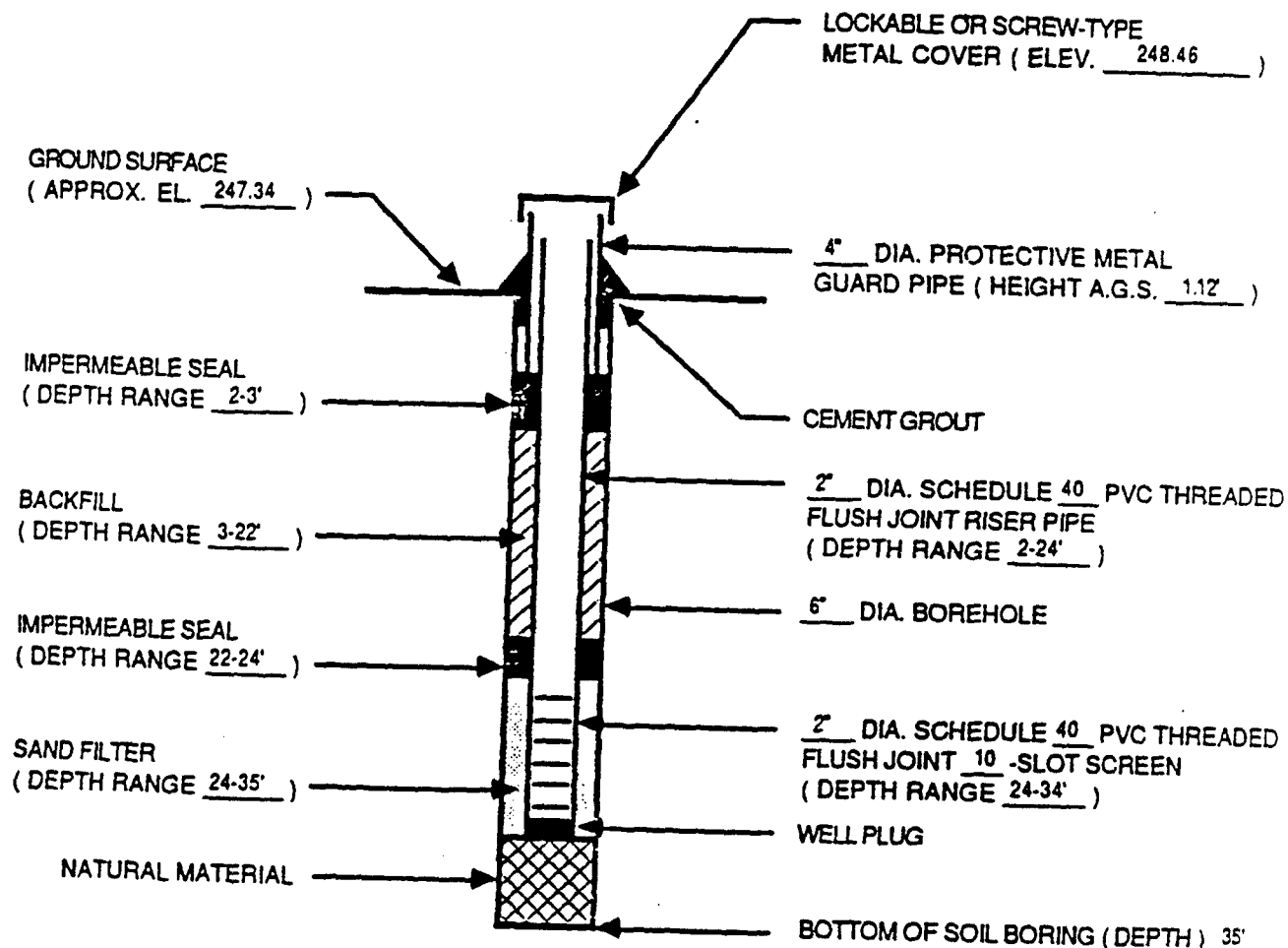
GROUNDWATER LEVEL:
DATE: 3/7/86
TIME: _____
FEET: 30.4'
METHOD: Tape
DATUM: T.C.

MONITORING WELL NO. WT-3
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: Ft. Devens
DATE
START: 2/6/86 FINISH: 2/6/86


SOIL SAMPLES TAKEN: No

EQUIPMENT CLEANING: Yes
METHOD: Steam clean and methanol rinse

MATERIAL TO FACILITATE DRILLING: No
TYPE: _____



MONITORING WELL
CROSS SECTION SCHEMATIC

 S E A Consultants Inc. Engineers/Architects	Project : Barson's Construction Landfill Closure Ft. Devens	Boring Log Boring No. SEA-3 Ref. No. 392-8511					
Contractor : Soil Exploration Corp. 5 Feb. & 6 Feb. 86 Engineer/Geologist : M. Schultz Boring Location : See Site Plan Ground Surface Elev. : 247.57 Water Level : 29.5' Date : 6 Feb. 86		Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon & NX Core Barrel Casing at : 0'					
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
No.	Pen (In) / Rec.	Depth (ft)	Blows/6"				
0.5	S-1	—	0'-2'	—	Brown, fine to medium SAND, trace to little coarse sand and fine gravel with occasional roots	(1)	Fine to medium SAND, trace to little coarse sand and fine gravel (SP)
1							
2							
3							
4	S-2	18/18	4-5.5	7	Brown, fine to medium SAND, trace coarse sand		
5				8			
6				10			
7							
8							(7.5') Coarse to fine SAND, trace fine gravel (SW)
9							
10							
11							
12	S-3	18/18	9-10.5	13	Brown, coarse to fine SAND, trace fine gravel		
13				15			
14				16			
15							
16	S-4	18/15	14-15.5	7	Brown, fine SAND, trace to little medium to coarse sand and fine gravel		(12.5') Fine to medium SAND, trace coarse sand and fine gravel (SP)
17				8			
18				9			
19							
20	S-5	18/16	19-20.5	7	Brown, fine to medium SAND, trace coarse sand		
				9			
				9			

Granular Soils		Cohesive Soils		Remarks: (1) S-1 from auger. (2) Sample S-6 and above dry. (3) Samples S-7 wet.
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-3
 Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



SEA Consultants Inc.
Engineers/Architects

Project : Barson's Construction
Landfill Closure
Ft. Davens

Boring Log

Boring No. SEA-3
Ref. No. 392-8511

Contractor : Soil Exploration Corp. 5 Feb. & 6 Feb. 86

Engineer/Geologist : M. Schultz

Boring Location : See Site Plan

Ground Surface Elev. : 247.57

Water Level : 29.5'

Date : 6 Feb. 86

Casing Size : 3-1/4" I.D. Hollow Stem

Sampler : 1-3/8" I.D. Split Spoon &
NX Core Barrel

Casing at : 0'

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
20.5							Fine to medium SAND, trace to little coarse sand (SP)
21							
21.5							
22							
22.5							
23							Brown, fine SAND, trace to little coarse sand
23.5							
24							
24.5	S-6	18/15	24-25.5	15		(2)	
25				20			
25.5				22			
26							
26.5							
27							
27.5							
28							Brown, fine to medium SAND, trace coarse sand
28.5							
29							
29.5	S-7	18/15	29-30.5	8		(3)	
30				8			
30.5				9			
31							
31.5							
32							
32.5							
33							Fresh to slightly weathered biotite GRANODIORITE with very closely to closely spaced, tight, planar joints; joints flat (0°-20°) to very steeply dipping (70° to 90°)
33.5							
34							
34.5	S-8	18/0	34-35.5	12			
35				16			
35.5				13			
36	S-9	18/0	35.5-37	8			
36.5				8			
37				10			
37.5							
38	S-10	0/0	37.5-	50/0"		(37.5)	Very hard to hard, dark grey, equigranular biotite GRANODIORITE
38.5				Coring Time			
39				7.5			
39.5	C-1	60/	37.5 to				
40			42.5	11			
		Recovery=	70%				
				6			

Granular Soils		Cohesive Soils	
Blows/ft	Density	Blows/ft	Density
0-4	V. Loose	<2	V. Soft
4-10	Loose	2-4	Soft
10-30	M. Dense	4-8	M. Stiff
30-50	Dense	8-15	Stiff
>50	V. Dense	15-30	V. Stiff
		>30	Hard

Remarks:

- (1) S-1 from auger.
- (2) Sample S-6 and above dry.
- (3) Samples S-7 wet.

Boring Log

Boring No. SEA-3
Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



S E A Consultants Inc.
Engineers/Architects

Project : Barson's Construction
Landfill closure
Ft. Devens

Boring Log

Boring No. SEA-3
Ref. No. 392-8511

Contractor : Soil Exploration Corp.
Engineer/Geologist : M. Schultz

Casing Size : 3-1/4" I.D. Hollow Stem
Sampler : 1-3/8" I.D. Split Spoon +
NX Core Barrel

Boring Location : See Site Plan

Ground Surface Elev. : 247.57

Water Level : 29.5'

Date : 6 Feb. 86

Casing at : 0'

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
40.5				6	Bottom of exploration at 42.5		Very hard to hard, dark gray, equigranular biotite GRANODIORITE (42.5) _____
41							
41.5							
42				11			
42.5							
43							
43.5							
44							
44.5							
45							
45.5							
46							
46.5							
47							
47.5							
48							
48.5							
49							
49.5							
50							
50.5							
51							
51.5							
52							
52.5							
53							
53.5							
54							
54.5							
55							
55.5							
56							
56.5							
57							
57.5							
58							
58.5							
59							
59.5							
60							

Granular Soils		Cohesive Soils		Remarks:
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log

Boring No. SEA-3
Ref. No. 392-8511

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SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corporation
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger & NX Cone Barrel

SEA GEOLOGIST/ENGINEER: J. Jammallo/M. Schultz

MONITORING WELL NO. BAR-4 & WT-4
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: Fort Devens Landfill
DATE
START: 2/7/86 FINISH: 2/10/86

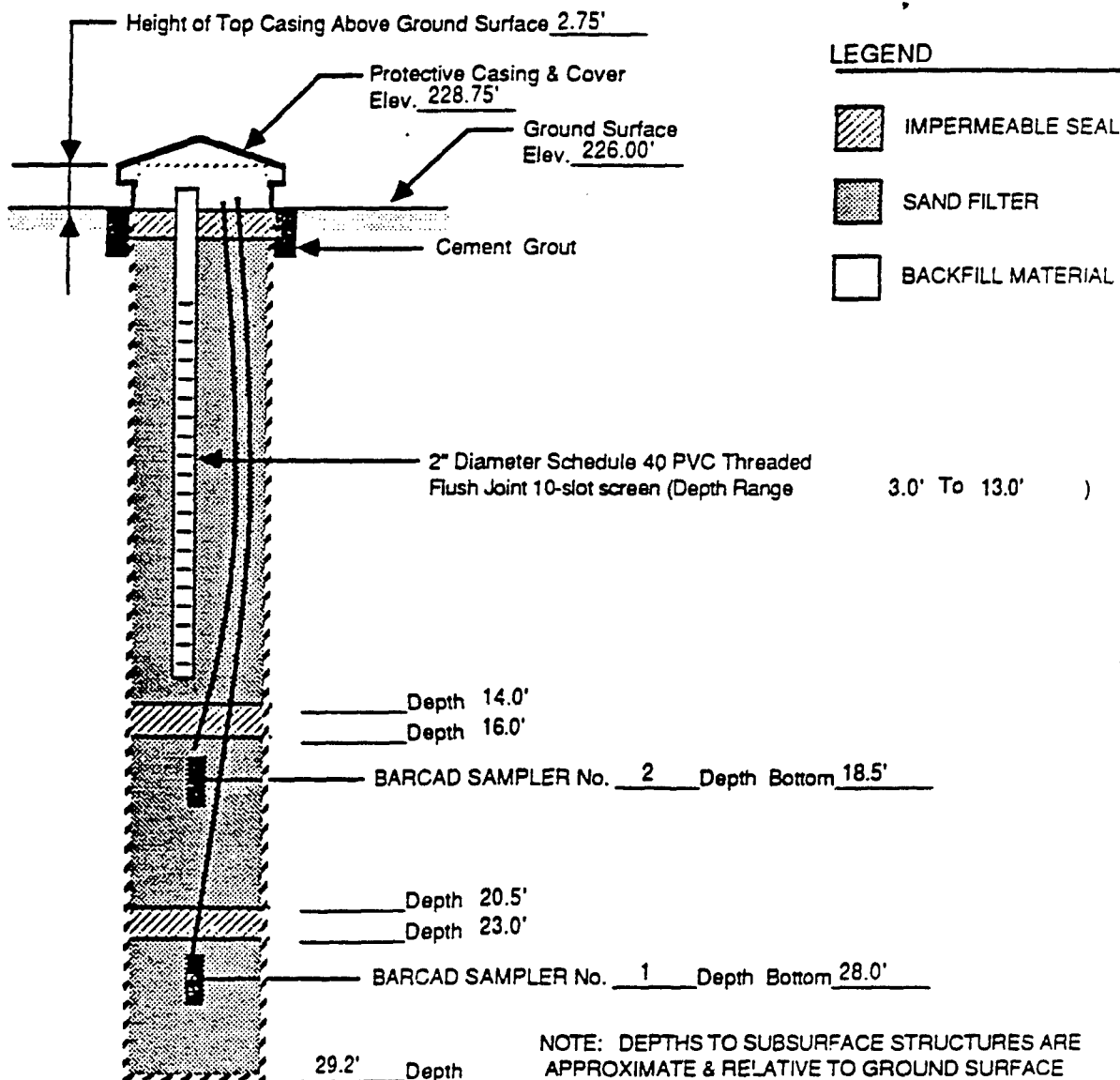
BARCAD SAMPLER WELL

	No. 1	No. 2	
GROUNDWATER DEPTH:	<u>10.5'</u>	<u>10.5'</u>	<u>10.9'</u>
DATE:	<u>3/17/86</u>	<u>3/17/86</u>	<u>3/17/86</u>
DATUM:	<u>TC</u>	<u>TC</u>	<u>TC</u>


SOIL SAMPLES TAKEN: Yes

EQUIPMENT CLEANING: Yes
METHOD: Steam Clean and Methanol Rinse

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water



MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Ft. Devens			Boring Log Boring No. SEA-4 Ref. No. 392-8511	
Contractor : Soil Exploration Corp. Date: 8 Feb. -10 Feb. 86 Engineer/Geologist : J. Jammalo Boring Location : See Site Plan Ground Surface Elev. : 226.00 Water Level : 8.8 Date : 10 Feb. 86 Casing at : 0					Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" Split Spoon & NX Core Barrel	

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
0.5	S-1	—	0'-2	—	FILL: Fine to medium SAND, trace to little coarse sand and fine to coarse gravel, trace silt with occasional roots	(1)	FILL: Fine to medium SAND, trace to little coarse sand and fine to coarse gravel, trace silt with occasional roots (SP)
1							
1.5							
2							
2.5							
3							
3.5							
4							
4.5	S-2	18/8	4-5.5	8	Brown, fine to medium SAND, little coarse sand and fine gravel		(3.0) Fine to medium SAND, little coarse sand and fine gravel (SP/SW)
5				5			
5.5				8			
6							
6.5							
7							
7.5							
8							
8.5							
9							
9.5	S-3	18/16	9-10.5	4	Brown, fine to coarse SAND		(7.5) Fine to coarse SAND (SW)
10				5			
10.5				4			
11							
11.5							
12							
12.5							
13							
13.5							
14							
14.5	S-4	18/2	14-15.5	5	Brown, fine to coarse SAND, trace fine gravel		- Trace fine gravel below 14'
15				3			
15.5				5			
16							
16.5							
17							
17.5							
18							
18.5							
19							
19.5	S-5	18/10	19-20.5	6	Brown, fine SAND, little to some medium to coarse sand and fine gravel		(17.5) Fine SAND, little to some coarse sand and fine gravel (SP/SW)
20				6			
				6			

Granular Soils		Cohesive Soils		Remarks:
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log Boring No. SEA-4 Ref. No. 392-8511	
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S E A Consultants Inc.
Engineers/Architects

Project : Barson's Construction
Landfill Closure
Ft. Devens

Boring Log

Boring No. SEA-4
Ref. No. 392-8511

Contractor : Soil Exploration Corp. Date: 8 Feb. -10 Feb. 86

Engineer/Geologist : J. Jammato

Boring Location : See Site Plan

Ground Surface Elev. : 226.00

Water Level : 8.8

Date : 10 Feb. 86

Casing Size : 3-1/4" I.D. Hollow Stem

Sampler : 1-3/8" Split Spoon & NX
Core Barrel

Casing at : 0

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
20.5							
21							
21.5							
22							
22.5							
23							
23.5							
24				15/2"			
24.5	S-6		24-24.2	60/0"	Gray, SILT and fine SAND, trace medium to coarse sand and gravel (glacial fill)		Fine SAND, little to some coarse sand and fine gravel (SP/SW)
25				CORING		(2)	(22.5) Silt and fine SAND, trace medium to coarse sand and gravel (SM)
25.5	C-1	60/60	24.2-29.2	11	Fresh to slightly weathered, biotite GRANODIORITE with closely to medium spaced, tight, planar joints; steeply dipping (70° to 90°), some healed		(24.2) Very hard to hard, dark gray, equigranular biotite GRANODIORITE
26				8			
26.5		Recovery	= 100%				
27				8			
27.5							
28				7			
28.5							
29				9			
29.5					Bottom of Exploration at 29.2'		(29.2)
30							
30.5							
31							
31.5							
32							
32.5							
33							
33.5							
34							
34.5							
35							
35.5							
36							
36.5							
37							
37.5							
38							
38.5							
39							
39.5							
40							

Granular Soils		Cohesive Soils		Remarks:
Blows/Ft	Density	Blows/Ft	Density	
0-4	V. Loose	<2	V. Soft	(1) S-1 from auger.
4-10	Loose	2-4	Soft	(2) All coring times in minutes
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log

Boring No. SEA-4
Ref. No. 392-851

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SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: 4" Seamless Casing, NX Core Barrel

SEA GEOLOGIST/ENGINEER: M. Schultz

MONITORING WELL NO. BAR-5
JOB NO: 392-8511 CLIENT: Barson's
LOCATION: Fl. Devens
DATE
START: 2/12/86 FINISH: 2/27/86

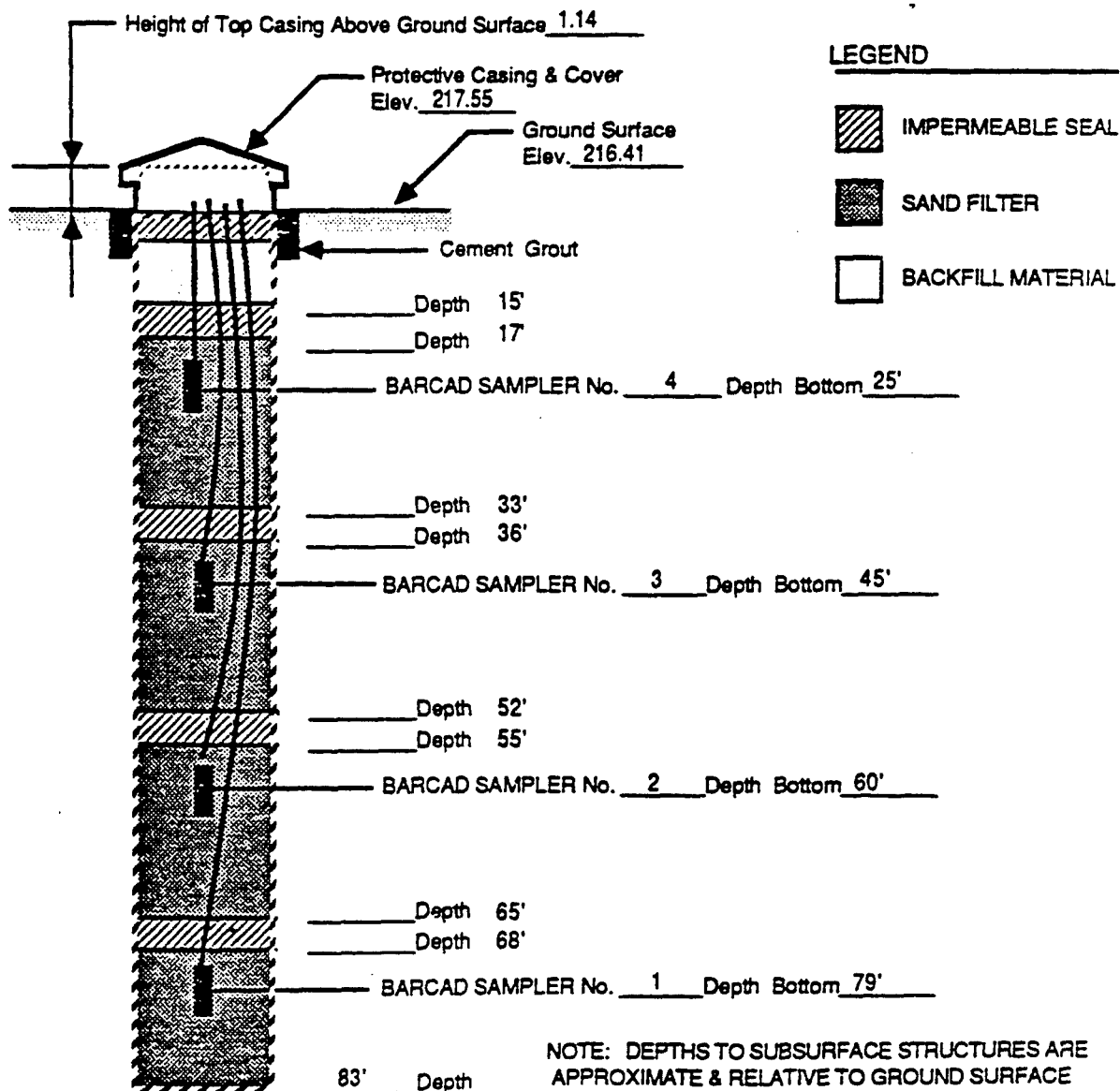
BARCAD SAMPLER

	No. 1	No. 2	No. 3	No. 4
GROUNDWATER DEPTH:	2.15'	3.50'	5.41'	4.2'
DATE:	3/7/86	3/7/86	3/7/86	3/7/86
DATUM:	T.C.	T.C.	T.C.	T.C.

SOIL SAMPLES TAKEN: Yes

EQUIPMENT CLEANING: Yes
METHOD: Steam clean and methanol rinse

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water



MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION



SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corp.
FOREMAN: Bob Seymour
METHOD: Hollow Stem Auger

SEA GEOLOGIST/ENGINEER: M. Gitten

GROUNDWATER LEVEL:

DATE: 2/27/86

TIME: 0

FEET: 22"

METHOD: Tape

DATUM: G.S.

MONITORING WELL NO. WT-5

JOB NO: 392-8511 CLIENT: Barson's

LOCATION: Ft. Devens Landfill

DATE

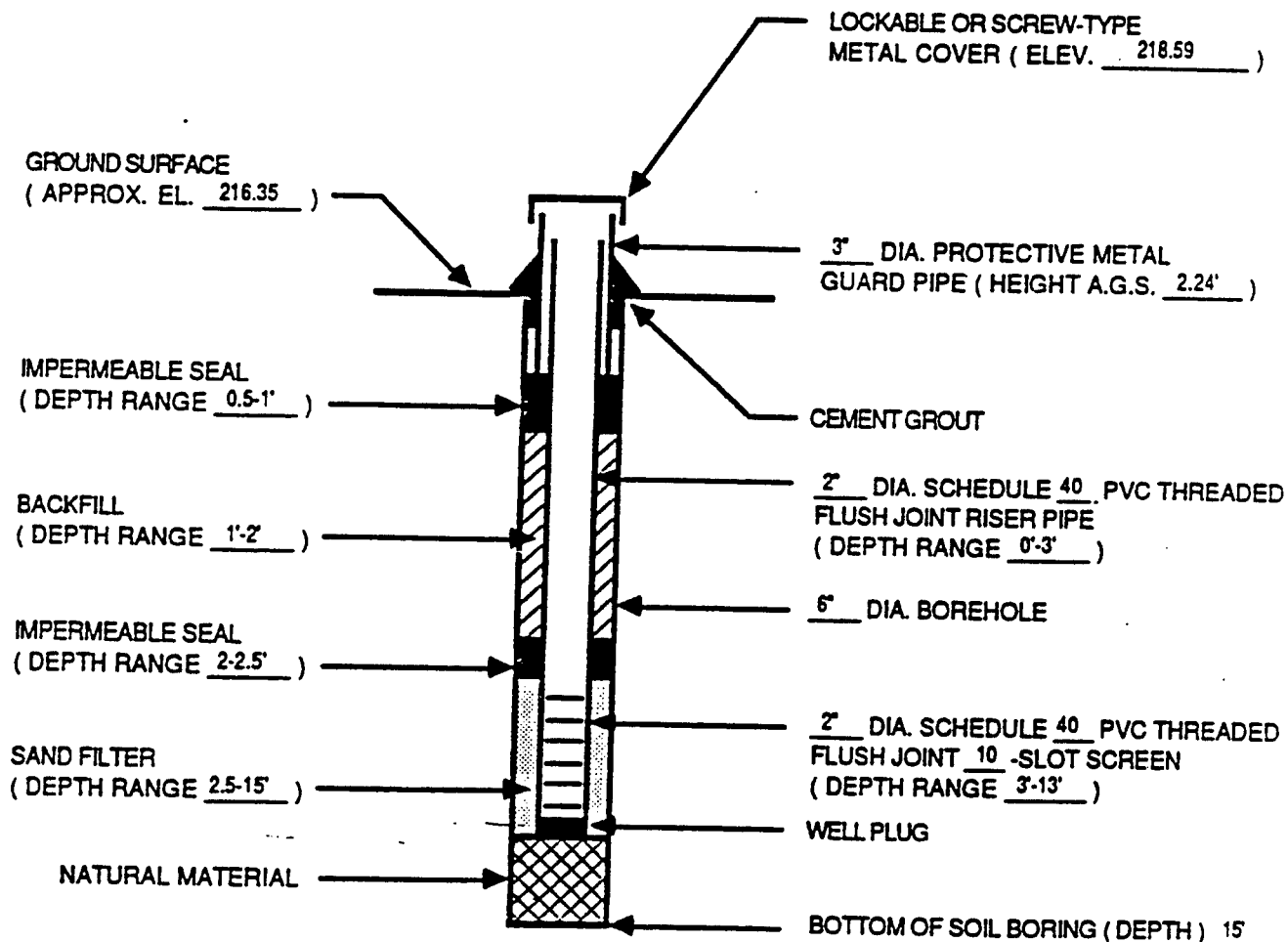
START: 2/28/86 FINISH: 2/28/86

SOIL SAMPLES TAKEN: No


EQUIPMENT CLEANING: Yes

METHOD: Steam clean and methanol rinse

MATERIAL TO FACILITATE DRILLING: No
TYPE: _____




MONITORING WELL
CROSS SECTION SCHEMATIC

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Ft. Devens			Boring Log Boring No. SEA-5 Ref. No. 392-851.																																		
Contractor : Soil Exploration Corp. Date: 12 Feb.-27 Feb. 86 Engineer/Geologist : M. Schultz Boring Location : See Site Plan Ground Surface Elev. : 218.41 Water Level : 2.2 Date : 27 Feb. 86					Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon & NX Core Barrel Casing at : 0																																		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description																																
	No.	Pen (in) /Rec.	Depth (ft)	Blows/ft																																			
0.5	S-1	—	0-2	—	Peat	(1)	Peat (PT)																																
1							(0.5) Fine SAND, some organic silt, little medium sand and peat (SP/OL)																																
1.5																																							
2																																							
2.5																																							
3																																							
3.5																																							
4																																							
4.5	S-2	15/15	4-5.3	20	Dark Brown, fine SAND, some organic silt, little medium sand and peat																																		
5				60																																			
5.5				60/3"																																			
6																																							
6.5																																							
7																																							
7.5																																							
8							(7.5) Fine to medium SAND, trace inorganic silt, coarse sand and fine gravel (SP)																																
8.5																																							
9																																							
9.5	S-3	18/12	9-10.5	17	Brown, fine to medium SAND, trace, inorganic silt, coarse sand, and fine gravel																																		
10				21																																			
10.5				15																																			
11																																							
11.5																																							
12																																							
12.5																																							
13																																							
13.5																																							
14																																							
14.5	S-4	18/18	14-15.5	4	Brown, fine SAND, little inorganic silt, trace fine gravel		(14.0) Fine SAND, little inorganic silt, trace fine gravel (SM)																																
15				2																																			
15.5				4																																			
16																																							
16.5																																							
17																																							
17.5																																							
18							(17.5) Fine SAND, trace inorganic silt (SP)																																
18.5																																							
19																																							
19.5	S-5	18/18	19-20.5	2	Light brown, fine SAND, trace inorganic silt																																		
20				2																																			
				6																																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">Granular Soils</th> <th colspan="2">Cohesive Soils</th> </tr> <tr> <th>Blows/ft</th> <th>Density</th> <th>Blows/ft</th> <th>Density</th> </tr> <tr> <td>0-4</td> <td>V. Loose</td> <td><2</td> <td>V. Soft</td> </tr> <tr> <td>4-10</td> <td>Loose</td> <td>2-4</td> <td>Soft</td> </tr> <tr> <td>10-30</td> <td>M. Dense</td> <td>4-8</td> <td>M. Stiff</td> </tr> <tr> <td>30-50</td> <td>Dense</td> <td>8-15</td> <td>Stiff</td> </tr> <tr> <td>>50</td> <td>V. Dense</td> <td>15-30</td> <td>V. Stiff</td> </tr> <tr> <td></td> <td></td> <td>>30</td> <td>Hard</td> </tr> </table>				Granular Soils		Cohesive Soils		Blows/ft	Density	Blows/ft	Density	0-4	V. Loose	<2	V. Soft	4-10	Loose	2-4	Soft	10-30	M. Dense	4-8	M. Stiff	30-50	Dense	8-15	Stiff	>50	V. Dense	15-30	V. Stiff			>30	Hard	Remarks: (1) Sample S-1 auger. (2) No recovery first attempt, redrove sampler to obtain soil for classification. (3) Drove casing to advance hole below 49 feet. (4) Evidence of soil type on end of sampler.			
Granular Soils		Cohesive Soils																																					
Blows/ft	Density	Blows/ft	Density																																				
0-4	V. Loose	<2	V. Soft																																				
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10-30	M. Dense	4-8	M. Stiff																																				
30-50	Dense	8-15	Stiff																																				
>50	V. Dense	15-30	V. Stiff																																				
		>30	Hard																																				

Boring LogBoring No. SEA-5
Ref. No. 392-851.1


Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects	Project : Barson Construction Landfill Closure Ft. Devens	Boring Log Boring No. SEA-5 Ref. No. 392-8511					
Contractor : Soil Exploration Corp. Date: 12 Feb.-27 Feb. 86 Engineer/Geologist : M. Schultz Boring Location : See Site Plan Ground Surface Elev. : 216.41 Water Level : 2.2 Date : 27 Feb. 86 Casing at : 0							
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
20.5							Fine SAND, trace inorganic silt (SP)
21							
21.5							
22							
22.5							
23							
23.5							
24							
24.5	S-6	18/18	24-25.5	5	Light brown, fine SAND, trace inorganic silt		
25							
25.5							
26							
26.5							
27							
27.5							
28							
28.5							
29							
29.5	S-7	18/18	29-30.5	1	Light brown, fine SAND, trace inorganic silt		
30							
30.5							
31							
31.5							
32							
32.5							
33							
33.5							
34							
34.5	S-8	18/18	34-35.5	4	Light brown, fine SAND, trace medium sand		- With trace medium sand below 34'
35				7			
35.5				7			
36							
36.5							
37							
37.5							
38							
38.5							
39							
39.5	S-9	18/12	39-40.5	6	Light brown, fine SAND, trace medium sand		
40				7			
				5			

Granular Soils		Cohesive Soils		Remarks: (1) Sample S-1 auger. (2) No recovery first attempt, redrove sampler to obtain soil for classification. (3) Drove casing to advance hole below 49 feet. (4) Evidence of soil type on end of sampler.
Blows/FL	Density	Blows/FL	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-5
 Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill closure Ft. Devens			Boring Log Boring No. SEA-5 Ref. No. 392-8511	
Contractor : Soil Exploration Corp. Engineer/Geologist : M. Schultz Boring Location : See Site Plan Ground Surface Elev. : 216.41				Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon + NX Core Barrel Casing at : 0'		
		Water Level : 2.2'		Date : 27 Feb. 86		

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
40.5							Fine to medium SAND, trace inorganic silt (SP)
41							
41.5							
42							
42.5							
43							
43.5							
44							
44.5	S-10	18/0	44-45.5	11	Light brown, fine to medium SAND, trace inorganic silt	(2)	
45				22			
45.5				15			
46							
46.5							
47							
47.5							
48							
48.5							
49							
49.5	S-11	18/12	49-50.5	13	Reddish brown, fine SAND, trace inorganic silt	(3)	
50				18			
50.5				19			
51							(53.0') Fine to coarse SAND, little to some fine to coarse gravel, little inorganic silt (SM/GM)
51.5							
52							
52.5							
53							
53.5							
54							
54.5	S-12	18/6	54.5-56	33	Brown, fine to coarse SAND, little to some fine gravel, little inorganic silt (glacial till)		
55				100			
55.5				60			
56							Brown, fine to coarse GRAVEL and fine to coarse SAND, little silt
56.5							
57							
57.5							
58							
58.5							
59							
59.5							
60	S-13	6/3	59.5-60	180/6"			

Granular Soils		Cohesive Soils		Remarks: (2) No recovery first attempt, redrove sampler to obtain soil for classification. (3) Drove casing to advance hole below 49 feet. (4) Evidence of soil type on end of sampler. (5) No recovery first attempt, redrove sampler to obtain soil for classification.
Blows/Ft	Density	Blows/Ft	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log Boring No. SEA-5 Ref. No. 392-8511	
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Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



S E A Consultants Inc.
Engineers/Architects

**Project : Barson's Construction
Landfill Closure
Ft. Devens**

Boring Log

Boring No. SEA-5
Ref. No. 392-8511

Contractor : Soil Exploration Corp.

Engineer/Geologist : M. Schultz

Boring Location : See Site Plan

Ground Surface Elev. : 216.41

Casing Size : 3-1/4" I.D. Hollow Stem

Sampler : 1-3/8" I.D. Split Spoon +
NX Core Barrel

Casing at : 0'

Water Level : 22'

Date : 27 Feb. 86

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
60.5							
61							
61.5							
62							
62.5							
63							
63.5							
64							
64.5							
65							
65.5							
66							
66.5							
67							
67.5							
68							
68.5							
69							
69.5							
70	S-14	18/0	69.5-71	10	Brown, fine SAND, trace inorganic silt	(4)	
70.5				11			
71				15			
71.5							
72							
72.5							
73							
73.5							
74							
74.5							
75							
75.5							
76	S-15	18/0	75.5-77	8	Brown, fine SAND, trace inorganic silt	(5)	
76.5				12			
77				18			
77.5							
78							
78.5	S-16	0/0	78	100/0"		(6)	
				Coring Time			
79	C-1	60/39	78-83	15	Fresh to slightly weathered, biotite GRANODIORITE with closely spaced, tight, planar joints; flat (0° to 20°) [Description Continued]		
79.5							
80				18			

Granular Soils		Cohesive Soils	
Blows/Ft.	Density	Blows/Ft.	Density
0-4	V. Loose	<2	V. Soft
4-10	Loose	2-4	Soft
10-30	M. Dense	4-8	M. Stiff
30-50	Dense	8-15	Stiff
>50	V. Dense	15-30	V. Stiff
		>30	Hard


Remarks:

- (2) No recovery first attempt, redrove sampler to obtain soil for classification.
- (3) Drove casing to advance hole below 49 feet
- (4) Evidence of soil type on end of sampler.
- (5) No recovery first attempt, redrove sampler to obtain soil for classification.

Boring Log

Boring No. SEA-5
Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill closure Ft. Devens			Boring Log Boring No. SEA-5 Ref. No. 392-8511		
Contractor : Soil Exploration Corp. Engineer/Geologist : M. Schultz Boring Location : See Site Plan Ground Surface Elev. : 216.41 Water Level : 2.2' Date : 27 Feb. 86				Casing Size : 3-1/4" I.D. Hollow Stem Sampler : 1-3/8" I.D. Split Spoon + NX Core Barrel Casing at : 0'			
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
80.5	C-1			10	[Description continued...] and steeply dipping (45° to 70°) with some very steeply (70° to 90°) dipping healed joints - many seams below 81' Bottom exploration at 83.0'	(7)	Very hard to hard, dark grey, equigranular biotite GRANODIORITE (83.0') _____
81	(Continued)						
81.5							
82	Recovery	= 65%	5				
82.5							
83				3			
83.5							
84							
84.5							
85							
85.5							
86							
86.5							
87							
87.5							
88							
88.5							
89							
89.5							
90							
90.5							
91							
91.5							
92							
92.5							
93							
93.5							
94							
94.5							
95							
95.5							
96							
96.5							
97							
97.5							
98							
98.5							
99							
99.5							
100							
Granular Soils		Cohesive Soils		Remarks: (7) Lost circulation below 81 feet.			
Blows/Ft.	Density	Blows/Ft.	Density				
0-4	V. Loose	<2	V. Soft				
4-10	Loose	2-4	Soft				
10-30	M. Dense	4-8	M. Stiff				
30-50	Dense	8-15	Stiff	Boring Log Boring No. SEA-5 Ref. No. 392-8511			
>50	V. Dense	15-30	V. Stiff				
		>30	Hard				

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



SEA Consultants Inc.
Engineers/Architects

Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corporation
FOREMAN: Jim Campbell
METHOD: Hollow Stem Auger

SEA GEOLOGIST/ENGINEER: M.P. Clark

GROUNDWATER LEVEL:
DATE: 10/8/86
TIME: 10:00
FEET: 28.65
METHOD: Water Level Indicator
DATUM: Top of Casing

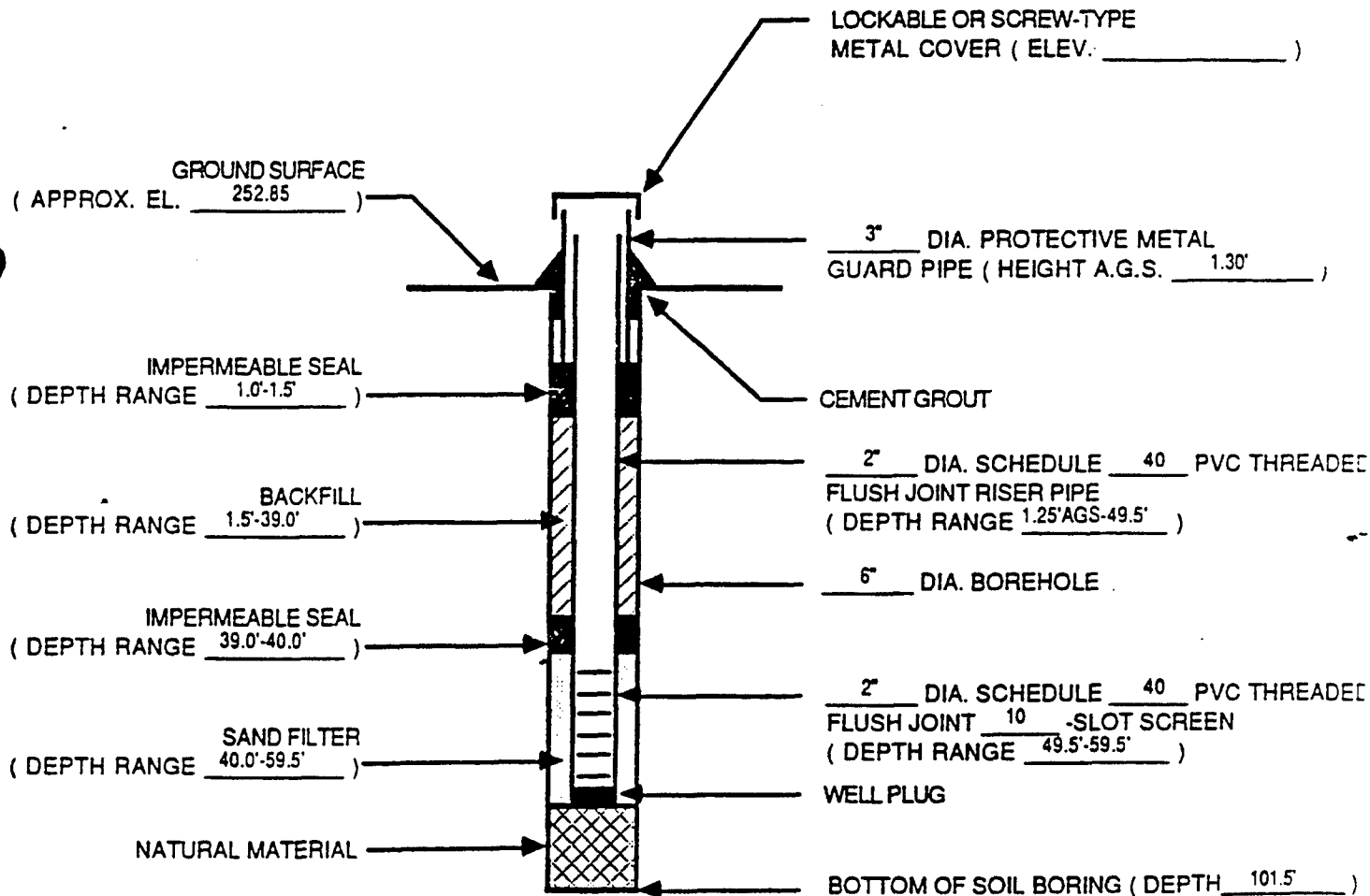
MONITORING WELL NO. WT-6
JOB NO: 392-8611 CLIENT: Barson's
LOCATION: Fort Devens Landfill
DATE
START: 8/25/86 FINISH: 8/26/86

SOIL SAMPLES TAKEN: Yes


EQUIPMENT CLEANING: Yes

METHOD: Steam Clean

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water



**MONITORING WELL
CROSS SECTION SCHEMATIC**


 S E A Consultants Inc. Engineers/Architects		Project : Barsons' Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-6 Ref. No. 392-8611	
Contractor : Soil Exploration Corporation Engineer/Geologist : M.P. Clark					Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon	
Boring Location : See Site Plan Ground Surface Elev. : 252.35' Water Level : 28.65' Date : 8/25-8/26/86 Casing at : N/A						

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
0.5	S-1	6/6	0-0.5	1	S-1 Brown, fine SAND, little medium sand, trace inorganic silt with roots. S-1A Brown to black fine SAND, little medium sand, trace inorganic silt		Fine SAND, little medium sand, trace inorganic silt (SP)
1	S-1A	12/10	0.5-1.5	4			
1.5				7			
2							
2.5							
3							
3.5							
4							
4.5							(4.5') Medium SAND, little coarse and fine sand, trace inorganic silt (SW)
5							
5.5	S-2	18/12	5-6.5	7	Tan to grey, fine to medium SAND, little coarse sand, trace inorganic silt		
6				6			
6.5				7			
7							
7.5							
8							
8.5							
9							
9.5							
10							
10.5	S-3	18/15	10-11.5	6	Tan to grey, medium to coarse SAND, little fine sand, trace inorganic silt		
11				5			
11.5				6			
12							
12.5							
13							
13.5							
14							
14.5							
15							
15.5	S-4	18/15	15-16.5	4	Tan to grey, medium SAND, little fine sand, trace inorganic silt		
16				4			
16.5				15			
17							
17.5							
18							
18.5							
19							
19.5							
20							
	S-5	18/16	20-21.5	5	See Page 2 of 6 for Description		See Page 2 of 6 for Description

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-6
 Ref. No. 392-8611

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 S E A Consultants Inc. Engineers/Architects		Project : Barsons' Construction Landfill Closure Fort Devens				Boring Log Boring No. SEA-6 Ref. No. 392-8611																																	
Contractor : Soil Exploration Corporation Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 252.35' Water Level : 28.65' Date : 8/25-8/26/86 Casing at : N/A						Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon																																	
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description																																
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"																																			
20.5				5	Tan to grey, medium SAND, little fine sand, trace inorganic silt		Medium to coarse SAND, little fine sand and fine gravel, trace inorganic silt (SW)																																
21				7																																			
21.5																																							
22																																							
22.5																																							
23																																							
23.5																																							
24																																							
24.5																																							
25																																							
25.5	S-6	18/15	25-26.5	7	Tan to grey, medium to coarse SAND, little fine sand, trace inorganic silt																																		
26				11																																			
26.5				9																																			
27																																							
27.5																																							
28																																							
28.5																																							
29																																							
29.5																																							
30																																							
30.5	S-7	18/12	30-31.5	9	Brown to tan, coarse SAND, little fine to medium sand and fine gravel, trace inorganic silt																																		
31				10																																			
31.5				10																																			
32																																							
32.5																																							
33																																							
33.5																																							
34																																							
34.5																																							
35																																							
35.5	S-8	18/15	35-36.5	8	Brown to tan, coarse SAND and fine GRAVEL, trace inorganic silt																																		
36				8																																			
36.5				11																																			
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Granular Soils		Cohesive Soils																																					
Blows/FL	Density	Blows/FL	Density																																				
0-4	V. Loose	<2	V. Soft																																				
4-10	Loose	2-4	Soft																																				
10-30	M. Dense	4-8	M. Stiff																																				
30-50	Dense	8-15	Stiff																																				
>50	V. Dense	15-30	V. Stiff																																				
		>30	Hard																																				

Boring Log Boring No. SEA-6 Ref. No. 392-8611	
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Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



S E A Consultants Inc.
Engineers/Architects

Project : Barson's Construction
Landfill Closure
Fort Devens

Boring Log

Boring No. SEA-6
Ref. No. 392-8611

Contractor : Soil Exploration Corp.

Engineer/Geologist : M.P. Clark

Boring Location : See Site Plan

Ground Surface Elev. : 252.85'

Water Level : 28.65'

Date : 8/25-8/26/86

Casing Size : See Note A

Sampler : 13/8" S.D. Split Spoon

Casing at : N/A

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
40.5	S-9	18/15	40-41.5	6	Brown, medium to coarse SAND, little fine gravel, trace inorganic silt		Fine to medium SAND, little coarse sand and fine gravel, trace inorganic silt (SW)
41				12			
41.5				12			
42							
42.5							
43					Brown, medium SAND, little coarse sand and fine sand, trace inorganic silt		
43.5							
44							
44.5							
45							
45.5	S-10	18/16	45-46.5	9	Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
46				4			
46.5				6			
47							
47.5							
48					Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
48.5							
49							
49.5							
50							
50.5	S-11	18/15	50-51.5	5	Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
51				6			
51.5				5			
52							
52.5							
53					Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
53.5							
54							
54.5							
55							
55.5	S-12	18/14	55-56.5	10	Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
56				12			
56.5				12			
57							
57.5							
58					See Page 4 of 6 for Description		See Page 4 of 6 for Description
58.5							
59							
59.5							
60							
	S-13	18/12	60-61.5	11	See Page 4 of 6 for Description		See Page 4 of 6 for Description


Granular Soils		Cohesive Soils	
Blows/Ft	Density	Blows/Ft	Density
0-4	V. Loose	<2	V. Soft
4-10	Loose	2-4	Soft
10-30	M. Dense	4-8	M. Stiff
30-50	Dense	8-15	Stiff
>50	V. Dense	15-30	V. Stiff
		>30	Hard

Remarks:
(A) 3 1/4" I.D. Hollow Stem Auger

Boring Log

Boring No. SEA-6
Ref. No. 392-8611

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.


 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring L Boring No. SEA-6 Ref. No. 392-8611	
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 252.85'					Casing Size : See Note A Sampler : 13/8" S.D. Split Spoon Casing at : N/A	
		Water Level : 28.85'		Date : 8/25-8/28/86		

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
60.5				9	Brown, fine to medium SAND, trace inorganic silt		Fine to medium SAND, little coarse sand, trace inorganic silt (SW)
61				9			
61.5							
62							
62.5							
63							
63.5							
64							
64.5							
65							
65.5	S-14	18/16	65-66.5	12			
66				14			
66.5				11	Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
67							
67.5							
68							
68.5							
69							
69.5							
70							
70.5	S-15	18/16	70-71.5	10	Brown, fine to medium SAND, little coarse sand, trace inorganic silt		
71				12			
71.5				13			
72							
72.5							
73							
73.5							
74							
74.5							
75							
75.5	S-16	18/8	75-76.5	10			
76				12			
76.5				16	Brown to tan, fine to medium SAND, little coarse sand, trace inorganic silt		
77							
77.5							
78							
78.5							(78.0') Fine SAND, trace inorganic silt (SP)
79							
79.5							
80							

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/FL	Density	Blows/FL	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-6
 Ref. No. 392-

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.


 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-6 Ref. No. 392-8611	
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark				Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon		
Boring Location : See Site Plan Ground Surface Elev. : 252.85'				Water Level : 28.65'		Date : 8/25-8/26/86
Casing at : N/A						

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
80.5	S-17	18/16	80-81.5	9	Brown, fine SAND, trace inorganic silt		Fine to very fine SAND, trace inorganic silt (SP)
81				12			
81.5				12			
82							
82.5							
83							
83.5							
84							
84.5							
85							
85.5	S-18	18/12	85-86.5	10	Brown, fine SAND, trace inorganic silt		
86				9			
86.5				11			
87							
87.5							
88							
88.5							
89							
89.5							
90							
90.5	S-19	18/18	90-91.5	6	Brown to tan, very fine SAND, trace inorganic silt		
91				9			
91.5				11			
92							
92.5							
93							(93.0') Fine SILTY SAND, trace clay (SM)
93.5							
94							
94.5							
95							
95.5	S-20	18/12	95-96.5	4	Gray to blue, fine SILTY SAND, trace clay		
96				7			
96.5				9			
97							
97.5							
98							
98.5							
99							
99.5							
100	S-21	18/15	100-101.5	6	See Page 6 of 6 for Description		See Page 6 of 6 for Description

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/FL	Density	Blows/FL	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-6
 Ref. No. 392-8611

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-6 Ref. No. 392-86		
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 252.85'					Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon Date : 8/25-8/26/86 Casing at : N/A		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
100.5				9	Gray to blue, fine SILTY SAND, trace clay (101.5) Bottom of Exploration		Fine SILTY SAND, trace clay (SM) (101.5)
101				7			
101.5							
102							
102.5							
103							
103.5							
104							
104.5							
105							
105.5							
106							
106.5							
107							
107.5							
108							
108.5							
109							
109.5							
110							
110.5							
111							
111.5							
112							
112.5							
113							
113.5							
114							
114.5							
115							
115.5							
116							
116.5							
117							
117.5							
118							
118.5							
119							
119.5							
120							

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/Ft	Density	Blows/Ft	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log
 Boring No. SEA-6
 Ref. No. 392-86

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



SEA Consultants Inc.
Engineers/Architects

Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corporation
FOREMAN: Jim Campbell
METHOD: Hollow Stem Auger/ Casing

SEA GEOLOGIST/ENGINEER: M.P. Clark

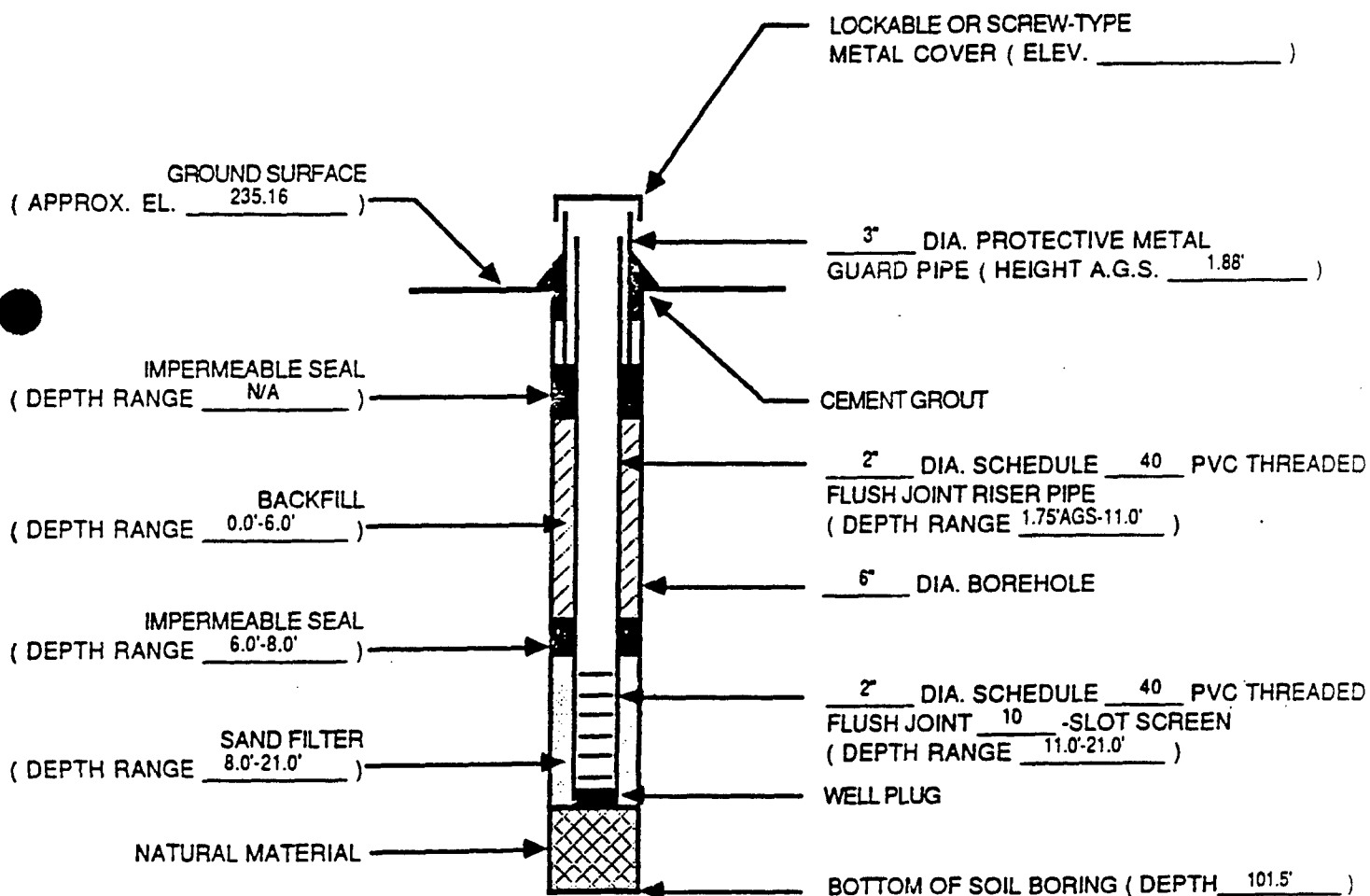
GROUNDWATER LEVEL:
DATE: 10/8/86
TIME: 11:00
FEET: 18.65
METHOD: Water Level Indicator
DATUM: Top of Casing

MONITORING WELL NO. WT-7
JOB NO: 392-8611 CLIENT: Barson's
LOCATION: Fort Devens Landfill
DATE
START: 9/2/86 FINISH: 9/4/86


SOIL SAMPLES TAKEN: Yes

EQUIPMENT CLEANING: Yes
METHOD: Steam Clean

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water



**MONITORING WELL
CROSS SECTION SCHEMATIC**

 S E A Consultants Inc. Engineers/Architects		Project : Barsons' Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-7 Ref. No. 392-86		
Contractor : Soil Exploration Corporation Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 235.16' Water Level : 18.65' Date : 9/2-9/4/86 Casing at : N/A					Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
0.5	S-1	18/16	0-1.5	4	Tan to brown, fine to medium SAND, little coarse sand, trace inorganic silt		Fine to medium SAND, little co- sand, trace inorganic silt (SV)
1				4			
1.5				4			
2							
2.5							
3							(3.0')
3.5							Fine SAND, trace inorganic silt (SP)
4							
4.5							
5							
5.5	S-2	18/15	5-6.5	6	Tan, fine SAND, trace inorganic silt		
6				7			
6.5				7			
7							
7.5							
8							
8.5							
9							
9.5							
10							
10.5	S-3	18/15	10-11.5	7	Tan, fine SAND, trace inorganic silt		
11				8			
11.5				8			
12							
12.5							
13							
13.5							
14							
14.5							
15							
15.5	S-4	18/15	15-16.5	5	Tan, fine SAND, trace inorganic silt		
16				8			
16.5				6			
17							
17.5							
18							
18.5							
19							
19.5							
20							
	S-5	18/15	20-21.5	4	See Page 2 of 6 for Description		See Page 2 of 6 for Description
Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger			
Blows/Ft.	Density	Blows/Ft.	Density				
0-4	V. Loose	<2	V. Soft				
4-10	Loose	2-4	Soft				
10-30	M. Dense	4-8	M. Stiff				
30-50	Dense	8-15	Stiff				
>50	V. Dense	15-30	V. Stiff				
		>30	Hard				

Boring Log
 Boring No. SEA-7
 Ref. No. 392-86113

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



S E A Consultants Inc.
Engineers/Architects

Project : Barsons' Construction
Landfill Closure
Fort Devens

Boring Log

Boring No. SEA-7
Ref. No. 392-8611392-8

Contractor : Soil Exploration Corporation
Engineer/Geologist : M.P. Clark

Casing Size : See Note A
Sampler : 1 3/8" I.D. Split Spoon

Boring Location : See Site Plan

Ground Surface Elev. : 235.15'

Water Level : 18.65'

Date : 9/2-9/4/88

Casing at : N/A


Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
20.5				7	Tan, fine SAND, trace inorganic silt		Very fine to fine SAND, trace inorganic silt (SP)
21				10			
21.5							
22							
22.5							
23					Tan, fine SAND, trace inorganic silt		
23.5							
24							
24.5							
25							
25.5	S-6	18/16	25-26.5	8			
26				9			
26.5				8			
27							
27.5							
28					Brown, very fine SAND, trace inorganic silt		
28.5							
29							
29.5							
30							
30.5	S-7	18/15	30-31.5	6			
31				8			
31.5				11			
32							
32.5							
33					Brown, fine SAND, trace inorganic silt		
33.5							
34							
34.5							
35							
35.5	S-8	18/12	35-36.5	5			
36				4			
36.5				7			
37							
37.5							
38							
38.5							
39							
39.5							
40							

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/Ft	Density	Blows/Ft	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log

Boring No. SEA-7
Ref. No. 392-86113

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-7 Ref. No. 392-8611		
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 235.16' Water Level : 18.65' Date : 9/2-9/4/86 Casing at : N/A					Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
40.5	S-9	18/15	40-41.5	7	Brown, fine SAND, trace inorganic silt		Fine SAND, little to no medium to coarse sand, trace inorganic silt (SP)
41				8			
41.5				9			
42							
42.5							
43							
43.5							
44							
44.5							
45							
45.5	S-10	18/12	45-46.5	9	Brown, fine SAND, little medium to coarse sand, trace inorganic silt		
46				10			
46.5				11			
47							
47.5							
48							
48.5							
49							
49.5							
50							
50.5	S-11	18/15	50-51.5	11	Brown, fine SAND, trace inorganic silt		
51				14			
51.5				16			
52							
52.5							
53							
53.5							
54							
54.5							
55							
55.5	S-12	18/12	55-56.5	11	Brown, fine sand, trace inorganic silt		
56				13			
56.5				20			
57							
57.5							
58							
58.5							
59							
59.5							
60							
	S-13	18/14	60-61.5	12	See Page 4 of 6 for Description		See Page 4 of 6 for Description
Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger			
Blows/Ft.	Density	Blows/Ft.	Density				
0-4	V. Loose	<2	V. Soft				
4-10	Loose	2-4	Soft				
10-30	M. Dense	4-8	M. Stiff				
30-50	Dense	8-15	Stiff				
>50	V. Dense	15-30	V. Stiff				
		>30	Hard				

Boring Log
 Boring No. SEA-7
 Ref. No. 392-8611

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



S E A Consultants Inc.
Engineers/Architects

Project : Barson's Construction
Landfill Closure
Fort Devens

Boring Log

Boring No. SEA-7
Ref. No. 392-8611

Contractor : Soil Exploration Corp.

Engineer/Geologist : M.P. Clark

Boring Location : See Site Plan

Ground Surface Elev. : 235.16'

Water Level : 18.55'

Date : 8/2-9/4/86

Casing Size : See Note A

Sampler : 1 3/8" I.D. Split Spoon

Casing at : N/A


Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
60.5				12	Brown, fine SAND, trace inorganic silt		Fine SAND, some medium sand, trace inorganic silt (SP)
61				15			
61.5							
62							
62.5							
63					Brown, fine SAND, trace inorganic silt		
63.5							
64							
64.5							
65							
65.5	S-14	18/15	65-66.5	10	Brown, fine SAND, trace inorganic silt		
66				10			
66.5				16			
67							
67.5							
68					Tan to brown, fine SAND, some medium sand, trace inorganic silt		
68.5							
69							
69.5							
70							
70.5	S-15	18/15	70-71.5	8	Tan to brown, fine SAND, some medium sand, trace inorganic silt		
71				11			
71.5				11			
72							
72.5							
73					Tan to brown, fine SAND, some medium sand, trace inorganic silt		
73.5							
74							
74.5							
75							
75.5	S-16	18/14	75-76.5	12	Tan to brown, fine SAND, some medium sand, trace inorganic silt		
76				12			
76.5				16			
77							
77.5							
78							
78.5							
79							
79.5							
80							

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log


Boring No. SEA-7
Ref. No. 392-8611

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-7 Ref. No. 392-8611		
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 235.15' Water Level : 18.65' Date : 9/2-9/4/86 Casing at : N/A					Casing Size : See Note A Sampler : 13/8" I.D. Split Spoon		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
80.5	S-17	18/18	80-81.5	15	Brown, fine SAND, trace inorganic silt		Fine SAND, little to no medium sand, trace inorganic silt (SP)
81				16			
81.5				20			
82							
82.5							
83							
83.5							
84							
84.5							
85							
85.5	S-18	18/16	85-86.5	12	Brown, fine SAND, trace inorganic silt		
86				15			
86.5				19			
87							
87.5							
88							
88.5							
89							
89.5							
90							
90.5	S-19	18/15	90-91.5	15	Brown, fine SAND, trace inorganic silt		
91				15			
91.5				17			
92							
92.5							
93							
93.5							
94							
94.5							
95							
95.5	S-20	18/15	95-96.5	19	Brown, fine SAND, trace inorganic silt		
96				16			
96.5				19			
97							
97.5							
98							
98.5							
99							
99.5							
100							
	S-21	18/16	100'-101.5'	16	See Page 6 of 6 for Description		See Page 6 of 6 for Description
Granular Soils		Cohesive Soils		Remarks: (A) 31/4" I.D. Hollow Stem Auger			
Blows/Ft.	Density	Blows/Ft.	Density				
0-4	V. Loose	<2	V. Soft				
4-10	Loose	2-4	Soft				
10-30	M. Dense	4-8	M. Stiff				
30-50	Dense	8-15	Stiff				
>50	V. Dense	15-30	V. Stiff				
		>30	Hard				

Boring Log
 Boring No. SEA-7
 Ref. No. 392-8611

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-7 Ref. No. 392-8611		
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 235.16'					Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon Date : 9/2-9/4/86 Casing at : N/A		
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
100.5				20	Brown, fine SAND, little medium sand, trace inorganic silt (101.5) Bottom of Exploration		Fine SAND, little to no medium sand, trace inorganic silt (101.5)
101				17			
101.5							
102							
102.5							
103							
103.5							
104							
104.5							
105							
105.5							
106							
106.5							
107							
107.5							
108							
108.5							
109							
109.5							
110							
110.5							
111							
111.5							
112							
112.5							
113							
113.5							
114							
114.5							
115							
115.5							
116							
116.5							
117							
117.5							
118							
118.5							
119							
119.5							
120							

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log Boring No. SEA-7 Ref. No. 392-8611
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CON-TEST Inc.
WATER AND AIR ENGINEERING

SAMPLE NUMBER	BLOWS PER 6 INCHES	INCHES RECOVERED INCHES DRIVEN	WATER ELEVATION	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	LOG OF BORING NO. <u>8D&8S</u>		TESTS
							DATE DRILLED: <u>2/14-2/19/90</u>	PROJECT: <u>FORT DEVENS</u>	
							JOB # <u>8329</u>	DETECTOR: <u>TIP 2</u>	
							DESCRIPTION		
					8D/8S				
					BENTONITE SLURRY				
				65'					
				70'					
				75'					
				80'					
				85'					
				90'					

COMMENTS: _____ _____ _____ _____	FILTER PACK: <u>66'6"</u> TO <u>72'</u>	WATER LEVEL MEASUREMENTS
	BENTONITE: <u>60'</u> TO <u>66'6"</u>	▽: <u>8D - 7.3</u>
	SCREEN: <u>71'</u> TO <u>69'6"</u>	DATUM: <u>TOP OF CASING</u>
		PURGING: <u>80 GALLONS</u>
GEOLOGIST: <u>A. SIMMONS</u> DRAWN BY: <u>J.A.D.</u>		



SEA Consultants Inc.
Engineers/Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

DRILLING CONTRACTOR: Soil Exploration Corporation
FOREMAN: Jim Campbell
METHOD: Auger, Drive and Wash

SEA GEOLOGIST/ENGINEER: M.P. Clark

MONITORING WELL NO. Bar-9 & WT-9
JOB NO: 392-8611 CLIENT: Barson's
LOCATION: Fort Devens Landfill
DATE
START: 9/10/86 FINISH: 9/15/86

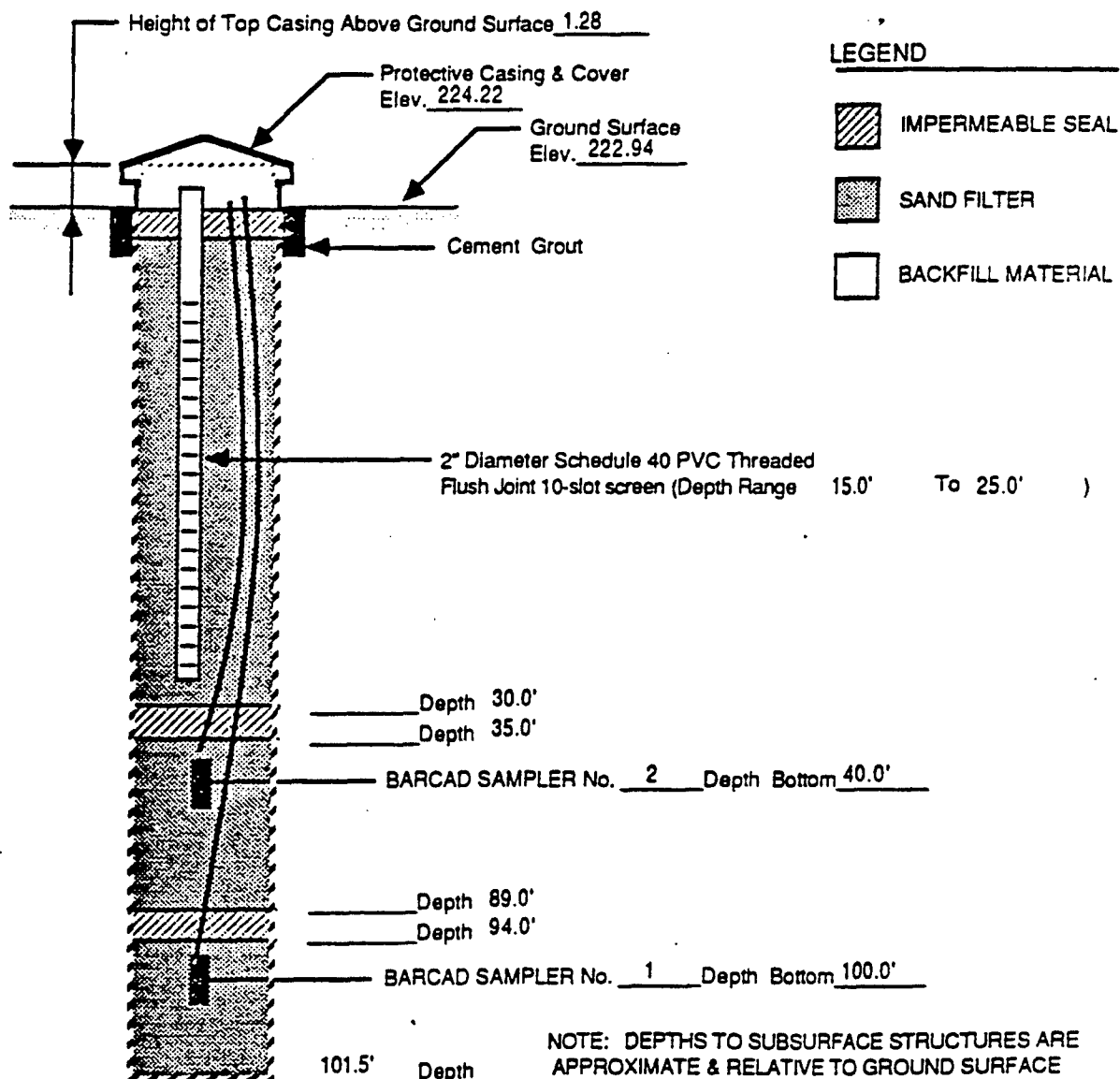
BARCAD SAMPLER WELL
No. 1 No. 2

GROUNDWATER DEPTH:	10.85	10.41	10.40
DATE:	10/8/86	10/8/86	10/8/86
DATUM:	Top	of	Casing

SOIL SAMPLES TAKEN:

EQUIPMENT CLEANING: Yes
METHOD: Steam Clean

MATERIAL TO FACILITATE DRILLING: Yes
TYPE: Water



MONITORING WELL CROSS-SECTION WITH BARCAD SAMPLER INSTALLATION



S E A Consultants Inc.
Engineers/Architects

**Project : Barsons' Construction
Landfill Closure
Fort Devens**

Boring Log

Boring No. SE A-9
Ref. No. 392-8611

Contractor : Soil Exploration Corp.

Engineer/Geologist : M.P. Clark

Boring Location : See Site Plan

Ground Surface Elev.: 222.94'

Casing Size : See Note A

Sampler : 1 3/8' I.D. Split Spoon

Water Level : 10.40'

Date : 9/10-9/15/86

Casing at : N/A

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
0.5	S-1	18/16	0-1.5	1	Brown, fine SAND, little medium sand, trace roots		Fine SAND, little medium sand, trace roots (SP) (1.0') Fine to coarse SAND, little fine gravel (SW)
1				5			
1.5				4			
2							
2.5							
3							
3.5							
4							
4.5							
5							
5.5	S-2	18/15	5-6.5	4	Brown to tan, fine to coarse SAND, little fine gravel		(8.0') Fine to coarse SAND, little fine gravel with occasional inorganic silt layers (SW - SM)
6				7			
6.5				6			
7							
7.5							
8							
8.5							
9							
9.5							
10							
10.5	S-3	18/14	10-11.5	12	Brown to tan, fine to coarse SAND, little fine gravel with occasional inorganic silt layers		
11				14			
11.5				11			
12							
12.5							
13							
13.5							
14							
14.5							
15							
15.5	S-4	18/15	15-16.5	5	Brown to tan, fine to coarse SAND, little fine gravel with occasional inorganic silt layers		
16				6			
16.5				9			
17							
17.5							
18							
18.5							
19							
19.5							
20							
20	S-5	18/12	20'-21.5'	9	See Page 2 of 6 for Description		See Page 2 of 6 for Description

Granular Soils		Cohesive Soils	
Blows/Ft.	Density	Blows/Ft.	Density
0-4	V. Loose	<2	V. Soft
4-10	Loose	2-4	Soft
10-30	M. Dense	4-8	M. Stiff
30-50	Dense	8-15	Stiff
>50	V. Dense	15-30	V. Stiff
		>30	Hard

Remarks:


(A) 3 1/4" I.D. Hollow Stem Auger

(1) Wash sample

Boring Log

Boring No. SE A-9
Ref. No. 392-6611

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 SEA Consultants Inc. Engineers/Architects		Project : Barsons' Construction Landfill Closure Fort Devens				Boring Log Boring No. SE A-9 Ref. No. 392-8611	
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark				Casing Size : See Note A Sampler : 13/8" I.D. Split Spoon			
Boring Location : See Site Plan Ground Surface Elev. : 222.94'				Water Level : 10.40'		Date : 9/10-9/15/86	
Casing at : N/A							

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
20.5				9	Brown, fine to coarse SAND, little fine gravel, trace inorganic silt		Fine to coarse SAND, little fine gravel, trace inorganic silt (SW-SM) (22.0')
21				9			
21.5							
22							
22.5							
23							
23.5							
24							
24.5							
25					Brown, silty fine SAND		
25.5	S-6	19/12	25-26.5	6			
26				7			
26.5				8			
27							(27.0') Fine to medium SAND, little coarse sand, trace inorganic silt (SW-SM)
27.5							
28							
28.5							
29							
29.5							
30					Brown to gray, fine to medium SAND, little coarse sand, trace inorganic silt	(1)	
30.5	S-7	18/0	30-31.5	7			
31				7			
31.5				8			
32							
32.5							
33							
33.5							
34							
34.5							
35					Brown to gray, fine to medium SAND, little coarse sand, trace inorganic silt		
35.5	S-8	WASH	30-35				
36							
36.5							
37							
37.5							
38							
38.5							
39							
39.5							
40							

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger (1) Wash sample
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	

Boring Log	
Boring No. SE A-9	
Ref. No. 392-8611	


Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.

 S E A Consultants Inc. Engineers/Architects	Project : Barson's Construction Landfill Closure Fort Devens	Boring Log Boring No. SEA-9 Ref. No. 392-8611					
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 222.94' Water Level : 10.40' Date : 9/10-9/15/86 Casing at : N/A							
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
40.5	S-9	WASH	35-40		Brown to gray, fine to coarse SAND, trace inorganic silt		Fine to coarse SAND, some to no fine gravel, trace to little inorganic silt (SW-SM)
41							
41.5							
42							
42.5							
43							
43.5							
44							
44.5							
45							
45.5	S-10	18/0	45-46.5	12	No recovery		
46				15			
46.5				19			
47							
47.5							
48							
48.5							
49							
49.5							
50							
50.5	S-11	18/16	50-51.5	17	Brown to gray, fine to coarse SAND, some fine gravel, little inorganic silt		
51				19			
51.5				14			
52							
52.5							
53							
53.5							
54							
54.5							
55							
55.5	S-12	18/15	55-56.5	18	Brown to gray, fine to coarse SAND, some fine gravel, little inorganic silt		
56				16			
56.5				13			
57							
57.5							
58							
58.5							
59							
59.5							
60							
	S-13	18/6	60'-61.5'	9	See Page 4 of 6 for Description		See Page 4 of 6 for Description

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger (1) Wash sample
Blows/Ft.	Density	Blows/Ft.	Density	
0-4	V. Loose	<2	V. Soft	
4-10	Loose	2-4	Soft	
10-30	M. Dense	4-8	M. Stiff	
30-50	Dense	8-15	Stiff	
>50	V. Dense	15-30	V. Stiff	
		>30	Hard	


Boring Log Boring No. SEA-9 Ref. No. 392-8611
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 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-9 Ref. No. 392-8511		
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 222.94'					Casing Size : See Note A Sampler : 1 3/8" I.D. Split Spoon Casing at : N/A		
Water Level : 10.40'		Date : 9/10-9/15/86					
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
60.5				14	Brown, fine to medium SAND, little coarse sand and fine gravel, trace inorganic silt		Fine to medium SAND, little coarse sand and fine gravel, trace inorganic silt
61				14			
61.5							
62							
62.5							
63							(63.07) Fine to medium SAND, little coarse sand (SW)
63.5							
64							
64.5							
65	S-14	WASH	61.5-65		Grey, fine to medium SAND, little coarse sand	1	
65.5							
66							
66.5							
67							
67.5							
68							
68.5							
69							
69.5							
70	S-15	WASH	65-70		Grey, fine to medium SAND, little coarse sand	1	
70.5							
71							
71.5							
72							
72.5							
73							
73.5							
74							
74.5							
75	S-16	WASH	70-75		Grey, fine to medium SAND, little coarse sand	1	
75.5							
76							
76.5							
77							
77.5							
78							
78.5							
79							
79.5							
80							
Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger (1) Wash sample			
Blows/Ft.	Density	Blows/Ft.	Density				
0-4	V. Loose	<2	V. Soft				
4-10	Loose	2-4	Soft				
10-30	M. Dense	4-8	M. Stiff				
30-50	Dense	8-15	Stiff				
>50	V. Dense	15-30	V. Stiff				
		>30	Hard				

Boring Log
 Boring No. SEA-9
 Ref. No. 392-8511

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.


 S E A Consultants Inc. Engineers/Architects		Project : Barson's Construction Landfill Closure Fort Devens			Boring Log Boring No. SEA-9 Ref. No. 392-8611	
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark				Casing Size : See Note A Sampler : 13/8" I.D. Split Spoon		
Boring Location : See Site Plan Ground Surface Elev. : 222.94'				Water Level : 10.40'		Date : 9/10-9/15/86
Casing at : N/A						

Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (In) /Rec.	Depth (ft)	Blows/6"			
80.5	S-17	WASH	75-80		Grey, fine to medium SAND, little coarse sand, trace inorganic silt	1	Fine to medium SAND, little coarse sand, trace inorganic silt (SW)
81							
81.5							
82							
82.5							
83							
83.5							
84							
84.5							
85							
85.5	S-18	WASH	80-85		Grey, fine to medium SAND, little coarse sand, trace inorganic silt	1	
86							
86.5							
87							
87.5							
88							
88.5							
89							
89.5							
90							
90.5	S-19	WASH	85-90		Grey, fine to medium SAND, little coarse sand, trace inorganic silt	1	
91							
91.5							
92							
92.5							
93							
93.5							
94							
94.5							
95							
95.5	S-20	WASH	90-95		Grey, fine to medium SAND, little coarse sand, trace inorganic silt	1	
96							
96.5							
97							
97.5							
98							
98.5							
99							
99.5							
100	S-21	WASH	95-100				

Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" LD. Hollow Stem Auger (1) Wash sample
Blows/Ft	Density	Blows/Ft	Density	
0-4 4-10 10-30 30-50 >50	V. Loose Loose M. Dense Dense V. Dense	<2 2-4 4-8 8-15 15-30 >30	V. Soft Soft M. Stiff Stiff V. Stiff Hard	

Boring Log	
Boring No. SEA-9	
Ref. No. 392-8611	

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity

 S E A Consultants Inc. Engineers/Architects	Project : Barson's Construction Landfill Closure Fort Devens	Boring Log Boring No. SEA-9 Ref. No. 392-8611					
Contractor : Soil Exploration Corp. Engineer/Geologist : M.P. Clark Boring Location : See Site Plan Ground Surface Elev. : 222.94' Water Level : 10.40' Date : 9/10-9/15/88 Casing at : N/A							
Depth (ft)	Sample				Sample Description	Remarks	Stratum Description
	No.	Pen (in) /Rec.	Depth (ft)	Blows/6"			
100.5					Grey, fine to medium SAND, little coarse sand, trace inorganic silt (101.5') Bottom of Exploration		Fine to medium SAND, little coarse sand, trace inorganic silt (SW) (101.5')
101							
101.5							
102							
102.5							
103							
103.5							
104							
104.5							
105							
105.5							
106							
106.5							
107							
107.5							
108							
108.5							
109							
109.5							
110							
110.5							
111							
111.5							
112							
112.5							
113							
113.5							
114							
114.5							
115							
115.5							
116							
116.5							
117							
117.5							
118							
118.5							
119							
119.5							
120							
Granular Soils		Cohesive Soils		Remarks: (A) 3 1/4" I.D. Hollow Stem Auger (1) Wash sample			
Blows/FL	Density	Blows/FL	Density				
0-4	V. Loose	<2	V. Soft				
4-10	Loose	2-4	Soft				
10-30	M. Dense	4-8	M. Stiff				
30-50	Dense	8-15	Stiff	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Boring Log Boring No. SEA-9 Ref. No. 392-8611 </div>			
>50	V. Dense	15-30	V. Stiff				
				Hard			

Information on this log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines may be transitional and approximate. Water level measurements have been made in the open boreholes at the time and location indicated, and may vary with time, geologic condition or construction activity.



SAMPLE NUMBER	BLOWS PER 6 INCHES	INCHES RECOVERED INCHES DRIVEN		WATER ELEVATION	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	LOG OF BORING NO. <u>8D&8S</u>		TESTS
								DATE DRILLED: <u>2/14-2/19/90</u>		
								PROJECT: <u>FORT DEVENS</u>		
								JOB # <u>8329</u>		
								DETECTOR: <u>TIP 2</u>		
								DESCRIPTION		
									PPB	
									.8	
	3,3,5	12	12		5'			12" LIGHT BROWN MEDIUM SAND. SOME ANGULAR BLACK ROCK FLECKS. WET.		
	4,5,6	12	12		10'			7" LIGHT FINE SAND BLACK FLECKS ROCK 5" LIGHT BROWN FINE SAND BLACK FLECKS ROCK	1.4	
	3,5,6	18	18		15'			15" LIGHT BROWN FINE SAND 3" LIGHT BROWN MEDIUM- COURSE SAND SOME FINE GRAVEL SUBROUNDED	N.D.	
	3,9,7	18	18		20'			18" MEDIUM BROWN MEDIUM- COURSE SAND TRACE OF SILT AND FINE GRAVEL	1.7	
	4,3,5	18	18		25'			18" MEDIUM BROWN MEDIUM- COURSE SAND TRACE OF SILT AND FINE GRAVEL	1.8	
					30'					

COMMENTS: AUGERS PLUGGED UP AFTER 25'. COULD NOT COLLECT A REPRESENTATIVE SAMPLE.

GEOLOGIST: A. SIMMONS DRAWN BY: J.A.D.

FILTER PACK: _____ TO _____

BENTONITE: 3' TO 6'

SCREEN: _____ TO _____

SLURRY: 6' TO 48'

WATER LEVEL MEASUREMENTS

▽:

DATUM: _____

PURGING: _____



CON-TEST Inc.
WATER AND AIR ENGINEERING

SAMPLE NUMBER	BLOWS PER 6 INCHES	INCHES RECOVERED INCHES DRIVEN	WATER ELEVATION	DEPTH ' IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	LOG OF BORING NO. <u>8D&8S</u>		TESTS
							DATE DRILLED: <u>2/14-2/19/90</u>	DESCRIPTION	
							PROJECT: <u>FORT DEVENS</u>		
							JOB # <u>8329</u>		
							DETECTOR: <u>TIP 2</u>		
					8D/8S				
					BENTONITE SLURRY				1.0
				35'					N.D.
				40'					
				45'					0.8
				50'					1.4
				55'					.6
									N.D.
				60'					N.D.
COMMENTS: _____					FILTER PACK: <u>48'</u> TO <u>60'</u>		WATER 1 _____ F F ~		
_____					BENTONITE: _____ TO _____		▽: <u>8S - 7.3</u>		
GEOLOGIST: <u>A. SIMMONS</u> DRAWN BY: <u>J.A.D.</u>					SCREEN: <u>53'8"</u> TO <u>52'5"</u>		DATUM: <u>TOP OF CASING</u>		
							PURGING: <u>140 GALLONS</u>		

con-test

WATER AND AIR ENGINEERING

SHL-10

P.O. BOX 591
EAST LONGMEADOW
MASSACHUSETTS 01028
(413) 525-1198

AS-BUILT WELL DIAGRAM & GEOLOGIC DESCRIPTION

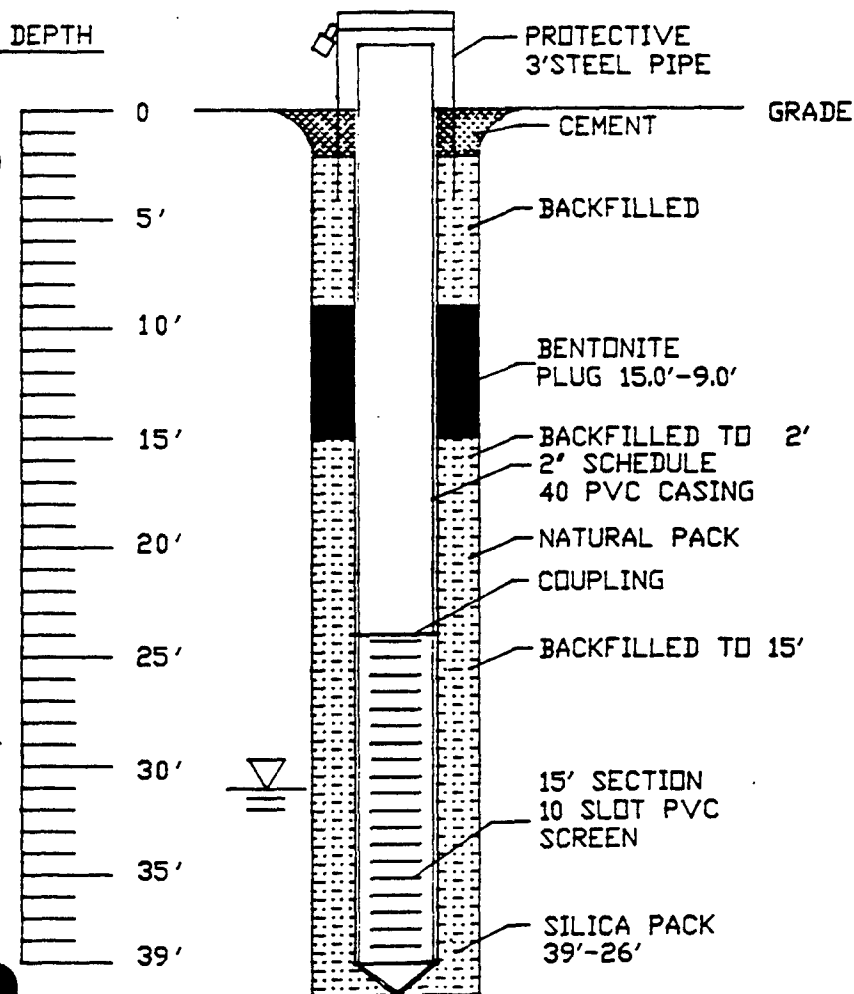
WELL NO. 1 PROJECT NO. 7641

CLIENT: FORT DEVENS
PRJ. NAME: SANITARY LANDFILL
LOCATION: FT. DEVENS, MASS.
GEOLOGIST: DAVID A. MACLEAN
DATE OF DRILL: 10/31/88
START TIME: 9:30 FINISH TIME: 16:30
BORING SIZE: 8"
CASING TYPE: PVC
CASING ID: SCHEDULE #40
TYPE OF FILTER PACK: NEW JERSEY SAND

GROUND WATER OBSERVATION

31.32 FT ON 1/19/89 DATE
MEASURED FROM PVC CASING
@ ELEVATION 249.11' = GROUND
WATER ELEVATION 217.79'
BENCH MARK WT 2
DRAWN BY P. ROSSI
DATE 2/10/89
APPROVED BY _____
DATE _____

SAMPLE NO. AND DESCRIPTION



1-5' BROWN SAND WITH SOIL DEVELOPMENT OVER
TAN, WELL SORTED, MEDIUM SAND.
2-10' TAN, WELL SORTED MEDIUM SAND.
3-15' TAN, WELL SORTED MEDIUM SAND.
4-20' TAN, WELL SORTED SAND.
5-25' TAN, WELL SORTED SAND.
6-30' TAN, WELL SORTED SAND WITH ONE SMALL GRAVEL LENSE, WET.
7-35' TAN, WELL SORTED FINE SAND.
8-40' TAN, WELL SORTED SAND OVER SILT, POORLY SORTED SAND OVER PHYLLITE. BEDROCK AT 39', ROCK CORE-FINE GRAINED, BIOTITE, CHLORITE, MUSCOVITE PELLITIC PHYLLITE TO SCHIST. STEEPLY DIPPING IRON STAINED JOINTS AT 60°-65°
RECOVERY 78%
DRILLING TIMES/FT. 6-7-20-10-5
END OF BORING AT 45'

con-test

WATER AND AIR ENGINEERING

SHC-11

P.O. BOX 591
EAST LONGMEADOW
MASSACHUSETTS 01028
(413) 525-1198

AS-BUILT WELL DIAGRAM & GEOLOGIC DESCRIPTION

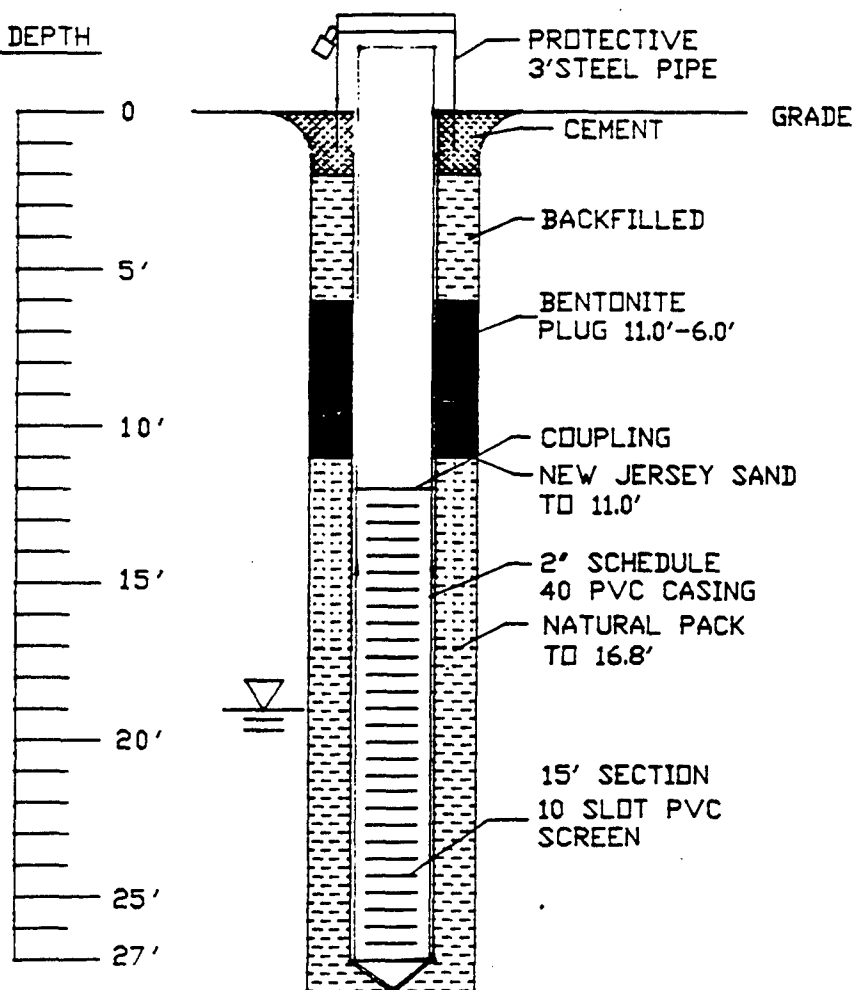
WELL NO. 2 PROJECT NO. 7641

CLIENT: FORT DEVENS
PRJ. NAME: SANITARY LANDFILL
LOCATION: FT. DEVENS, MASS.
GEOLOGIST: DAVID A. MACLEAN
DATE OF DRILL: 11/3/88
START TIME: 9:30 FINISH TIME: 16:30
BORING SIZE: 8"
CASING TYPE: SCHEDULE #40
CASING ID: PVC
TYPE OF FILTER PACK: NEW JERSEY SAND

GROUND WATER OBSERVATION

19.02 FT ON 1/19/89 DATE
MEASURED FROM PVC CASING
@ ELEVATION 236.43 GROUND
WATER ELEVATION 217.41
BENCH MARK WT 2
DRAWN BY P.ROSSI
DATE 2/10/89
APPROVED BY _____
DATE _____

DEPTH



SAMPLE NO. AND DESCRIPTION

1-5' COARSE, POORLY SORTED SAND, MINOR SILT.
2-10' MEDIUM SAND, WELL SORTED, LITTLE SILT.
3-15' MEDIUM SAND, WELL SORTED, LITTLE SILT.
4-20' MEDIUM SAND, WELL SORTED, LITTLE SILT, SATURATED
5-25' MEDIUM SAND, WELL SORTED, LITTLE SILT.
6-30' MEDIUM SAND, WELL SORTED.
7-35' MEDIUM TO COARSE, POORLY SORTED SAND.
8-40' MEDIUM SAND POORLY SORTED.
BEDROCK CORE DESCRIPTION-
COARSE GRAINED, LIGHT GREY, QUARTZ, PLAGIOCLASE, BIODITE, FOLIATED GNEISS, STEEPLY DIPPING FOLIATION OF BETWEEN 60°- 70°
DRILLING TIMES/MIN. 5-5-7-5-2
78% RECOVERY
END OF BORING 45'

SHC-12

P.O. BOX 591
EAST LONGMEADOW
MASSACHUSETTS 01028
(413)525-1198

con-test

WATER AND AIR ENGINEERING

AS-BUILT WELL DIAGRAM & GEOLOGIC DESCRIPTION

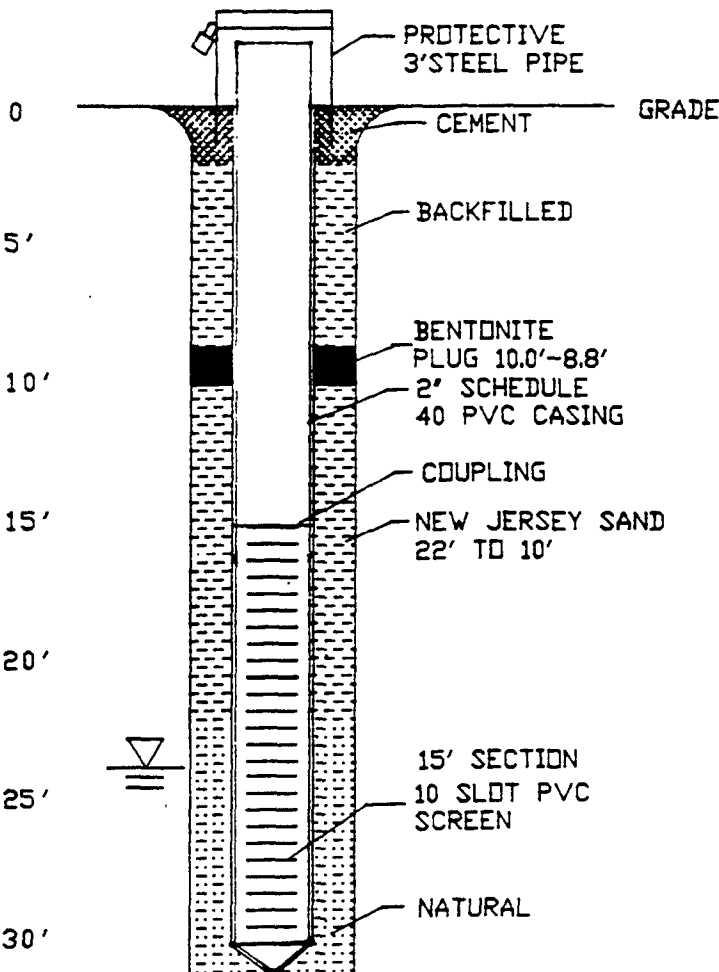
WELL NO. 3 PROJECT NO. 7641

CLIENT: FORT DEVENS
PRJ. NAME: SANITARY LANDFILL
LOCATION: FT. DEVENS, MASS.
GEOLOGIST: DAVID A. MACLEAN
DATE OF DRILL: 12/8/88
START TIME: 9:00 FINISH TIME: 16:00
BORING SIZE: 8"
CASING TYPE: PVC
CASING ID: SCHEDULE #40
TYPE OF FILTER PACK: NEW JERSEY SAND

GROUND WATER OBSERVATION

23.64 FT ON 1/19/89 DATE
MEASURED FROM PVC
@ ELEVATION 248.46 = GROUND
WATER ELEVATION 224.82
BENCH MARK WT 2
DRAWN BY P.ROSSI
DATE 2/10/89
APPROVED BY _____
DATE _____

DEPTH



SAMPLE NO. AND DESCRIPTION

1-5' COARSE, POORLY SORTED SAND.
2-10' COARSE, POORLY SORTED SAND.
3-15' COARSE, POORLY SORTED SAND.
4-20' COARSE, POORLY SORTED SAND OVER MEDIUM WELL SORTED SAND.
5-25' COARSE, POORLY SORTED SAND.
6-30' COARSE, POORLY SORTED SAND.
7-35' COARSE, POORLY SORTED SAND.
8-40' COARSE, POORLY SORTED SAND.
9-45' COARSE, POORLY SORTED SAND.
10-50' COARSE, POORLY SORTED SAND.
11-55' FINE, MEDIUM TO WELL SORTED SAND.
12-60' FINE GRAINED SILTY SAND WITH COARSE GRAVEL.
END OF BORING 60'



SAMPLE NUMBER	BLOWS PER 6 INCHES	INCHES RECOVERED / INCHES DRIVEN	WATER ELEVATION	DEPTH IN FEET	WELL OR PIEZOMETER CONSTRUCTION	GRAPHIC LOG	LOG OF BORING NO. <u>4</u>		TESTS
							DATE DRILLED: <u>2/19/90</u>	PROJECT: <u>FORT DEVENS</u>	
							JOB # <u>8329</u>	DETECTOR: <u>TIP 2</u>	
							DESCRIPTION		
									ppb
	4,8,10	7 / 18		5'			4' MEDIUM BROWN SILTY FINE-MEDIUM SAND ,		0.4
							3' LIGHT BROWN FINE-COARSE SAND TRACE FINE GRAVEL		
	2,3,4	18 / 18		10'			18' MEDIUM BROWN FINE SAND		0.2
	2,1,2	18 / 18		15'			18' MEDIUM BROWN FINE SAND TRACE SILT		N.D.
	1,2,2	18 / 18		20'			18' MEDIUM BROWN FINE SAND TRACE SILT		N.D.
				25'					
				30'					

COMMENTS:

GEOLOGIST:

DRAWN BY: J.A.D.

FILTER PACK: 3'6" TO 21'6"

BENTONITE: 3'6" TO 1'8"

SCREEN: 20' TO 5'

WATER LEVEL MEASUREMENTS

▽: 6.75'

DATUM: TOP OF CASING

PURGING: 75 GALLONS

DRILLING LOG of BORING No. SHL-14A

Page 1 of 2

State MASSACHUSETTS Start Date 7/14/91
 Location FORT DEVENS Completion Date 7/15/91
 Drilling Firm E & E DRILLING Ground Elevation 270.00
 Type of Drill DIEDRICH D-50 Total Depth of Boring 27.7'
 Driller PAUL BARTH
 Geologist LISA HELTON

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks
270.00		Ground Surface					
270	1	0.0'-2.0': <u>SAND</u> (SM): medium brown to light brown, low moisture, fine grained, loose, some silt, non-plastic; thick black rubber and burned twigs (fill) from 1'-1.5'.				11	Surface conditions: Grass covered slope above landfill.
	2					10	
	3					12	
	4					13	Spl Spn Run 1: 0.0'-2.0' 1.5' recovery. OVA: spoon (0 ppm), hole (> 1,000 ppm), head space (2 ppm). Augered from 2.0'-5.0'.
265	5	5.0'-7.0': <u>SAND</u> (SM): gray-brown, moderate moisture, coarse, loose, some silt, non-plastic; clear and brown plastics (fill) throughout.				6	Spl Spn Run 2: 5.0'-7.0' 0.5' recovery.
	6					6	OVA: spoon (40 ppm), hole (> 1,000 ppm), head space (59 ppm).
	7					7	Augered from 7.0'-10.0'.
	8						
	9						
260	10	10.0'-12.0': <u>CLAY</u> (CH): light gray, moderate moisture, high plasticity, trace silt; few large subangular phyllite cobbles (fill).				46	Spl Spn Run 3: 10.0'-12.0' 0.4' recovery. OVA: spoon (6 ppm), hole (500 ppm), head space (200 ppm).
	11					57/1'	Augered from 12.0'-13.0'.
	12						Auger refusal at 13.0'.
	13	13.0'-18.4': <u>GRANODIORITE TO GNEISS</u> : boulders, hard.					Core Run 1: 13.0'-18.4' RQD: .7%.
	14						
255	15						

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DRILLING LOG of BORING No. SHL-14A

Page 2 of 2

State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks
250-	17						
	18						
	19	18.4'-24.0': <u>GRANODIORITE TO GNEISS</u> : same as above.					Core Run 2: 18.4'-24.0' RQD: 0%.
	20						
	21						
	22						
	23						
	24	24.0'-26.1: <u>FOLIATED GRANITE</u>					Core Run 3: 24.0'-27.7' RQD: 47%.
245-	25						
	26	26.1'-27.7': <u>GRANODIORITE</u> : hard, fractures at 24.8'					Abandoned boring was
	27	and 26.2', sound.					tremie grouted to ground surface on 7/15/91.
							CONSTRUCTION SUMMARY Cem.: 564 dry lbs.. Cem./Bent.: 5%.

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DRILLING LOG of BORING No. SHL-14B

Page 1 of 1

State MASSACHUSETTS Start Date 7/14/91
 Location FORT DEVENS Completion Date 7/14/91
 Drilling Firm E & E DRILLING Ground Elevation 270.00
 Type of Drill DIEDRICH D-50 Total Depth of Boring 15.0'
 Driller PAUL BARTH
 Geologist LISA HELTON

Elev.	Depth	Description	Lithology	Sample No. and	Synho	Blow Count	Remarks
270.00		Ground Surface					
270	1	0.0'-5.0': SAND (SM): medium brown, low moisture, medium grained, some silt, non-plastic (fill).					Descriptions are based on the examination of auger cuttings. Auger Run 1: 0.0'-5.0' OVA: hole (14 ppm), head space (70 ppm).
	2						
	3						
	4						
265	5	5.0'-10.0': SAND (SM): same as above, except gray-brown, clear plastic and a plastic ring (used to hold 6-packs) observed in cuttings (fill).					Auger Run 2: 5.0'-10.0' OVA: hole (60 ppm), head space (120 ppm).
	6						
	7						
	8						
	9						
260	10	10.0'-15.0': SAND (SM): same as above; much trash (rags, plastic, metal can - fill).					Auger Run 3: 10.0'-15.0' OVA: hole (0 ppm), head space (20 ppm).
	11						
	12						
	13						Abandoned boring was tremie grouted to ground surface on 7/14/91.
	14						
255	15						CONSTRUCTION SUMMARY Cem.: 470 dry lbs.. Cem./Bert.: 5%

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DRILLING LOG of BORING No. SHL-14C

Page 1 of 1

State MASSACHUSETTS Start Date 7/15/91
 Location FORT DEVENS Completion Date 7/15/91
 Drilling Firm E & E DRILLING Ground Elevation 270.00
 Type of Drill DIEDRICH D-50 Total Depth of Boring 12.0'
 Driller PAUL BARTH
 Geologist LISA HELTON

Elev.	Depth	Description	Lithology	Sample No. and Symbol	Blow Count	Remarks
270.00		Ground Surface				
270	1	0.0'-5.0': SAND (SM): medium brown, low moisture, fine to medium grained, some silt, non-plastic (fill).				Descriptions are based on the examination of auger cuttings. Auger Run 1: 0.0'-5.0' OVA: hole (80 ppm), head space (6 ppm).
265	5	5.0'-10.0': SAND (SM): same as above; much trash (plastic, candy wrappers, rags - fill).				Auger Run 2: 5.0'-10.0' OVA: hole (500 ppm), head space (15 ppm).
260	10	10.0'-15.0': SAND (SM): same as above (fill).				Auger Run 3: 10.0'-12.0' Auger refusal at 12.0'. OVA: hole (500 ppm), head space (14 ppm).
	12					Abandoned boring was tremie grouted to ground surface on 7/15/91. CONSTRUCTION SUMMARY Cem.: 188 dry lbs.. Cem./Bent.: 5%.

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DRILLING LOG of WELL No. SHL-15

Page 1 of 2

State MASSACHUSETTS Start Date 7/12/91
 Location FORT DEVENS Completion Date 7/13/91
 Drilling Firm E & E DRILLING Ground Elevation 259.03
 Type of Drill DIEDRICH D-50 Groundwater Depth
 Driller PAUL BARTH at completion 17.18 ∇
 on 12/12/91 16.89 ∇
 Geologist LISA HELTON Total Depth of Boring 25.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
259.03		Ground Surface					Stickup = 1.72	
	1	0.0'-2.0': sandy <u>SILT</u> (SM): brown-black, dry, loose, non-plastic, subangular cobbles and roots throughout.				3 5 10 16	Spl Spn Run 1: 0.0'-2.0' 0.3' recovery. OVA: spoon and hole (0 ppm), head space (0.4 ppm). Collected archive sample. Augered from 2.0'-5.0'.	
255	2	2.0'-5.0': <u>SAND</u> (SP): gray-brown, dry, medium to coarse grained, loose, subrounded gravels throughout.						
	3							
	4							
	5					6	Spl Spn Run 2:	
	6					10	5.0'-7.0'	
	7					10	0.8' recovery. OVA:	
	8					9	spoon and hole (0 ppm), head space (0.3 ppm). Collected archive sample. Augered from 7.0'-10.0'.	
250	9							

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DRILLING LOG of WELL NO. SHL-15

Page 2 of 2

State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
245	11	10.0'-12.0': SAND (SP): gray-brown, moderate moisture, medium to coarse grained, loose, organics and subrounded pebbles throughout.				6	Spl Spn Run 3:	
						7	10.0'-12.0'	
	12					9	1.3' recovery. OVA:	
	13					13	spoon and hole (0 ppm), head space (0.2 ppm).	
240	14	15.0'-17.0': SAND (SP): same as above, except wet.					Collected archive sample. Augered from 12.0'-15.0'.	
	15					4	Spl Spn Run 4:	
	16					8	15.0'-17.0'	
	17					9	1.4' recovery. OVA:	
	18	20.0'-22.0': CLAY (CL): medium brown, wet, moderate plasticity, subrounded pebbles and cobbles throughout, little sand.				27	spoon and hole (0 ppm), head space (0.8 ppm).	
	19						Collected archive sample. Augered from 17.0'-20.0'.	
	20					12	Spl Spn Run 5:	
	21					38	20.0'-22.0'	
	22					15	0.7' recovery OVA:	
						12	spoon and hole (0 ppm), head space (0.8 ppm).	
							Collected archive sample. Augered from 22.0'-25.0'.	
							OVA: hole (0 ppm).	
							CONSTRUCTION SUMMARY	
							Well: Hole dia.: 10"	
							screen/casing dia.: 4".	
							slot size: 0.010".	
							Material Qty.:	
							Filter Pk.: 500lbs.	
							Bent. Pel.: 15 dry gallons.	
							Cem.: 564 dry lbs..	
							Cem./Bent.: 5%.	
							Stickup measured from ground surface to top of inner casing.	

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DRILLING LOG of BORING No. SHL-16A

Page 1 of 2

State MASSACHUSETTS Start Date 6/15/91

Location FORT DEVENS Completion Date 6/15/91

Drilling Firm E & E DRILLING Ground Elevation 258.00

Type of Drill DIEDRICH D-50 Total Depth of Boring 18.0'

Driller PAUL BARTH

Geologist AMIN AYUBCHA

Elev.	Depth	Description	Lithology	Sample No. and Symbol	Blow Count	Remarks
258.00		Ground Surface				
	1	0.0'-0.5': <u>FILL</u> : black, dry fill with mixture of sand, gravel, brick, debris, roots, vegetation, and charcoal.			6	Spl Spn Run : 0.0'-2.0' 1.8' recovery. OVA: spoon and hole (0 ppm), head space (0.2 ppm).
	2	0.5'-2.5': <u>SAND (SP)</u> : tan to brown, slightly moist, medium to coarse grained, with 1/4" size boulders; 60% quartz, <5% clay in matrix, low to very low plasticity, loose, mostly rounded elements.			6	Collected archive sample.
255	3	2.5'-9.5': <u>SAND (SP)</u> : gray, clean, trace of moisture, medium to coarse grained, 1/4-1/2" size boulders; 80-90% quartz, 5-10% micas, 10% other metamorphosed minerals, no plasticity, loose, slightly angular elements.			7	Augered from 2.0'-5.0'.
	4				8	
	5					
	6				4	Spl Spn Run 2: 5.0'-7.0' 1.6' recovery. OVA: spoon and hole (0 ppm), head space (0.1 ppm).
	7				7	Collected archive sample.
	8				12	Augered from 7.0'-10.0'.
250	9				12	Encountered a boulder at 9.5' BGS that was passed through with high pressure.
	10	9.5'-14.0': <u>SAND/GRAVEL (SP)</u> : gray-yellowish mixture, slightly moist, stiff, fine grained; 60% quartz, 10-15% silt in matrix, abundant quartz boulders, metamorphosed rock, slightly plastic, dense, glacial deposits; large boulders encountered during drilling.			17	Large boulders from 9.5' downward.
	11				35	Spl Spn Run 3: 10.0'-12.0' 1.7' recovery. OVA: spoon, hole, and head space (0 ppm).
	12				75	Collected archive sample.
	13				80	Augered from 12.0'-15.0'
245	14	14.0'-17.5': <u>GLACIAL SILTY TIL</u> (GM): brownish, wet, very fine silty sand with numerous large boulders of igneous quartzitic rocks; 80% quartz, 5% clay in matrix, low plasticity, slightly dense, stiff.				
	15				53	Spl Spn Run 4: 15.0'-17.0' 1.2' recovery. OVA: spoon
					60	

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DRILLING LOG of BORING No. SHL-16A

Page 2 of 2

State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and Symbol	Blow Count	Remarks
	17	subangular elements.				and hole (0 ppm). Collected archive sample. Water first encountered at 15' BGS. Augered 17.0'-17.5'. Abandoned boring was tremie grouted to surface on 6/15/91. CONSTRUCTION SUMMARY Cem.: 658 dry lbs., Cem./Bent.: 5%.

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DRILLING LOG of BORING No. SHL-16B

Page 1 of 1

State MASSACHUSETTS Start Date 7/10/91
 Location FORT DEVENS Completion Date 7/10/91
 Drilling Firm E & E DRILLING Ground Elevation 258.00
 Type of Drill DIEDRICH D-50 Total Depth of Boring 23.7'
 Driller PAUL BARTH
 Geologist LISA HELTON

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks
258.00		Ground Surface					
	1						Dry hole.
	2						
255	3						
	4						
	5						Abandoned boring.
	6						Boring was tremie grouted
	7						to ground surface on
	8						7/10/91.
250	9						
	10						Auger refusal at 9.0'.
	11						
	12						MATERIAL QUANTITY:
	13						Cem.: 470 dry lbs.
245	14						Cem./Bent.: 5%
	15						

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DRILLING LOG of BORING No. SHL-16C

Page 1 of 1

State MASSACHUSETTS Start Date 7/12/91
 Location FORT DEVENS Completion Date 7/12/91
 Drilling Firm E & E DRILLING Ground Elevation 258.00
 Type of Drill DIEDRICH D-50 Total Depth of Boring 9.0'
 Driller PAUL BARTH
 Geologist LISA HELTON

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks
258.00		Ground Surface					
	1						Dry hole.
	2						
255	3						
	4						
	5						Abandoned boring.
	6						Boring was tremie grouted
	7						to ground surface on
	8						7/12/91.
250	9						Auger refusal at 9.0'.
							MATERIAL QUANTITY:
							Cem.: 188 dry lbs.
							Cem./Bent.: 5%.

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DRILLING LOG of WELL No. SHL-17

Page 1 of 2

Date	MASSACHUSETTS	Start Date	6/14/91
Location	FORT DEVENS	Completion Date	6/14/91
Drilling Firm	E & E DRILLING	Ground Elevation	232.77
Type of Drill	DIEDRICH D-50	Groundwater Depth	
Driller	PAUL BARTH	at completion	6.20 ∇
Geologist	AMIN AYUBCHA	on 12/12/91	5.66 ∇
		Total Depth of Boring	17.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and Symbol	Blow Count	Remarks	Well Const.
227.77		Ground Surface				Stickup = 1.80	
	1	0.0'-0.25': TOPSOIL (MH): black clayey silt, 50-60% clay slightly moist, moderate plasticity, stiff, with vegetation.			3	Sp1 Spn Run 1: 0.0'-2.0'	
	2	0.25'-2.0': SAND (SP): gray, slightly moist, coarse grained with abundant boulders of quartz (gravel locally), >70% quartz, 5% clay in the matrix, loose, well rounded elements.			12	1.5' recovery. OVA: spoon, hole, and head space (0 ppm). Collected archive sample. Augered from 2.0'-5.0'.	
230	3	2.0'-6.0': SAND (SP): dark gray, wet, coarse grained, 50-60% quartz, 20-30% micas and other ferro-magnesian minerals, low or no plasticity, loose.			17		
	4				23		
	5	6.0'-10.5': silty SAND (SM): gray, wet, 70-75% quartz, 5-10% micas and other ferro-magnesian minerals, low plasticity, loose, rare boulder.			3	Sp1 Spn run 2: 5.0'-7.0'	
	6				4	1.3' recovery. OVA: spoon, hole, and head space (0 ppm). Collected archive sample. First water encountered at 6' BGS. Augered from 7.0'-10.0'.	
225	7				5		
	8						
	9						

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DRILLING LOG of WELL NO. SHL-17

Page 2 of 3

State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
220	11	10.5'-17.0': SAND (SP): dark gray, wet, very coarse grained sand and gravelly sand, boulders of black metamorphic rocks; some thin layers of clear silty sand, 60% quartz, >20% ferro-magnesian, low or no plasticity, loose, rare grains of feldspar.				1	Sp1 Spn Run 3:	
	12					2	10.0'-12.0'	
	13					3	1.7' recovery. OVA:	
	14					4	spoon, hole, and head space (0 ppm). Collected samples:	
	15						(1) 8oz. jar for TOC analysis,	
	16						(2) 8oz. jars for Geotechnical archive.	
	17					5	Augered from	
						6	12.0'-15.0'.	
						6	Sp1 Spn Run 4:	
						7	15.0'-17.0'	
							1.8' recovery. OVA: spoon and head space (0 ppm), hole (0.2 ppm). Collected archive sample.	
							CONSTRUCTION SUMMARY	
							Well: Hole dia.: 10".	
							screen/casing dia.: 4".	
							slot size: 0.010".	
							Material Qty.:	
							Filter Pk.: 500lbs.	
							Bent. Pel.: 15 dry gallons.	
							Cem.: 470 dry lbs..	
							Cem./Bent.: 5%.	
							Stickup measured from ground surface to top of inner casing.	

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DRILLING LOG of WELL No. SHL-18

Page 1 of 3

State MASSACHUSETTS Start Date 6/15/91

Location FORT DEVENS Completion Date 6/16/91

Drilling Firm E & E DRILLING Ground Elevation 236.59

Type of Drill DIEDRICH D-50 Groundwater Depth

Driller PAUL BARTH at completion 17.80 ✓

Geologist AMIN AYUBCHA on 12/12/91 17.12 ✓

Total Depth of Boring 30.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
236.59		Ground Surface					Stickup = 1.80	
235	1	0.0'-10.0': SAND (SP): gray, slightly moist, fine to very fine grained, 80% quartz, <5% micas and other metamorphosed minerals. Trace of roots, low plasticity, slightly moist on top 1'. Mixture of rounded and angular grains.				2	Spl Spn Run 1:	
	2					3	0.0'-2.0'	
	3					4	1.8' recovery. OVA:	
	4					6	spoon, hole, and head space (0 ppm). Collected archive sample.	
	5						Augered from 2.0'-5.0'.	
	6					3	Organic, blackish sand was observed at 4'-5' on auger cuttings.	
230	7					4	Spl Spn Run 2:	
	8					5	5.0'-7.0'	
	9						1.7' recovery. OVA: spoon, hole, and head space (0 ppm). Collected archive sample.	
							Augered from	

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DRILLING LOG of WELL NO. SHL-18

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State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
225	11	10.0'-15.0': SAND (SP): same as above, slightly coarser grained.				4	7.0'-10.0'.	
	12					8	Spl Spn Run 3:	
	13					8	10.0'-12.0'	
	14					10	1.6' recovery. OVA:	
	15						spoon, hole, and head	
	16	15.0'-22.0': SAND (SP): same as 0-10' interval, wet at 16' BGS, small isolated boulders of quartz.					space (0 ppm). Collected archive sample.	
	17					3	Augered from 12.0'-15.0'.	
220	18					5	Spl Spn Run 4:	
	19					5	15.0'-17.0'	
	20					6	1.8' recovery. OVA:	
	21						spoon, hole, and head	
	22						space (0 ppm). Collected archive sample	
	23						Augered from 17.0'-20.0'.	
215	24					4	Spl Spn Run 5:	
	25					3	20.0'-22.0'	
	26					5	1.8' recovery. OVA:	
	27	22.0'-30.0': SAND (SP): same as above, highly saturated, slightly darker.				5	spoon and hole (0 ppm). Collected archive sample and TOC sample.	
	28						Split Spoon was pushed and a second spoon was driven to obtain a sufficient sample volume..	
210	29					4	Augered from 22.0'-25.0'.	
	30					3	Spl Spn Run 6: 25.0'-27.0'	
						5	Collected archive sample. Augered from 27.0'-30.0'.	
							CONSTRUCTION SUMMARY Well: Hole dia.: 10". screen/casing dia.:	

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DRILLING LOG of WELL NO. SHL-18

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State MASSACHUSETTS Location FORT DEVENS

Ev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
							4". slot size: 0.010". Material Qty.: Filter Pk.: 900lbs. Bent. Pel.: 17.5 dry gallons. Cem.: 564 dry lbs.. Cem./Bent.: 5%. Stickup measured from ground surface to top of inner casing.	

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DRILLING LOG of WELL No. SHL-19

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State MASSACHUSETTS Start Date 6/16/91
 Location FORT DEVENS Completion Date 6/17/91
 Drilling Firm E & E DRILLING Ground Elevation 239.45
 Type of Drill DIEDRICH D-50 Groundwater Depth
 Driller PAUL BARTH at completion 22.00 ∇
 on 12/12/91 20.67 ∇
 Geologist AMIN AYUBCHA Total Depth of Boring 31.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
239.45		Ground Surface					Stickup = 1.89	
235	1	0.0'-1.0': <u>SAND</u> (SP): dark gray, slightly moist, fine grained, vegetation on top, 50-70% quartz, <4-5% clay in matrix, very low plasticity, loose, subangular to well rounded grains.				1	Spl Spn Run 1:	
	2	1.0'-4.5': <u>SAND</u> (SP): gray, dry, clear, fine to very fine grained quartz sand, 70-80% quartz, 5-10% ferro-magnesians of micas, no plasticity, slightly angular element.				1	0.0'-2.0'	
	3					2	1.7' recovery. OVA:	
	4					4	spoon, hole, and head space (0 ppm). Collected archive sample. Augered from 2.0'-5.0'.	
	5	4.5'-16.0': <u>SAND</u> (SP): dark gray, dry, medium to coarse grained, 50% quartz, 30-40% micas and metamorphosed rock debris, low to very low plasticity, loose, subangular grains, trace of oxidized minerals, occasional thin layer (2-3") of silty sand.				3	Spl Spn Run 2:	
	6					5	5.0'-7.0'	
	7					5	1.8' recovery. OVA:	
	8					8	spoon, hole, and head space (0 ppm). Collected archive sample. Augered from 7.0'-10.0'.	
230	9							

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DRILLING LOG of WELL NO. SHL-19

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
225-	11					5	Spl Spn Run 3:		
						5	10.0'-12.0'		
	12					7	1.7' recovery. OVA:		
						9	spoon, hole, and head space (0 ppm). Collected archive sample.		
	13						Augered from 12.0'-15.0'.		
220-	14					3	Spl Spn Run 4:		
						5	15.0'-17.0'		
	16					5	1.3' recovery. OVA:		
	17	16.0'-21.0': silty SAND (SM): white-grayish, dry, very similar to the 4.5-16' interval, loose, no plasticity, rounded to subangular grains, trace of isolated boulder of metamorphosed rock.				9	spoon, hole, and head space (0 ppm). Collected archive sample.		
	18						Augered from 17.0'-20.0'.		
215-	19								
	20					4	Spl Spn Run 5:		
						12	20.0'-22.0'		
	21	21.0'-21.5': SAND (SM): same as above, slightly coarser, more sand than silt.				13	1.4' recovery. OVA:		
	22	21.5'-22.0': SAND (SP): orange and black (organic), very wet, coarse grained, abundant boulders of quartz, 2" of oily black and rusty sand, numerous fragments of schist and granitic rock, 50-60% quartz, 30% metamorphosed ferro-magnesians and micas, no plasticity.				14	spoon, hole, and head space (0 ppm). Collected archive sample.		
210-	23	22.0'-25.0': SAND (SP): gray, wet, medium to coarse grained, some boulders of quartz, thin layer (2-3") of fine grained sand, 60-70% quartz, 5-10% metamorphosed ferro-magnesians, trace of oxidized grains, no plasticity, loose.					Augered from 22.0'-25.0'.		
	24					3	Water at 22' BGS.		
	25					5	Measured after stabilization.		
	26					8	Spl Spn Run 6:		
	27					12	25.0'-27.0'		
	28						1.5' recovery. OVA:		
	29						spoon and hole (0 ppm), head space (0.4 ppm).		
	30						Collected archive sample.		
							Augered from 27.0'-31.0'.		
							CONSTRUCTION SUMMARY		
							Well: Hole dia.: 10".		
							screen/casing dia.:		

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State		MASSACHUSETTS		Location		FORT DEVENS		
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
							4: slot size: 0.010". Material Qty.: Filter Pk.: 400lbs. Bent. Pel.: 20 dry gallons. Cem.: 564 dry lbs.. Cem./Bent.: 5% Stickup measured from ground surface to top of inner casing.	

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DRILLING LOG of WELL No. SHL-20

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State MASSACHUSETTS Start Date 7/10/91
 Location FORT DEVENS Completion Date 7/13/91
 Drilling Firm E & E DRILLING Ground Elevation 235.55
 Type of Drill ACKER 82 Groundwater Depth
 Driller DON CAMPBELL at completion 15.00 ∇
 Geologist ROBERT A. MEYERS on 12/12/91 17.63 ∇
 Total Depth of Boring 64.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	well Const.
235.55		Ground Surface					Stickup = 1.29	
235	1	0.0'-0.4': <u>SILT</u> (MH): tan, dry, with fine sand and some rounded gravel.				4	Spl Spn Run 1:	
		0.4'-2.0': <u>SAND</u> (MH): tan to brown, fine to medium grained, with some rounded to subangular gravel. Sand is composed of angular fragments of 90% quartz, 10% mafics, <1% mica for this split spoon.				6	0.0'-2.0'	
	2					10	1.2' recovery. OVA:	
	3					14	spoon and hole (0 ppm).	
	4						Collected archive sample.	
	5						Augered from 2.0'-5.0'.	
230	6	5.0'-7.0': <u>SAND</u> (SP): tan to gray, moist, medium grained, with some limonitic staining, 90% quartz, 10% mafics, <1% mica.				4	Spl Spn Run 2:	
	7					5	5.0'-7.0'	
	8					5	1.0' recovery. OVA:	
	9					6	spoon and hole (0 ppm).	
							Collected archive sample.	
							Augered from 7.0'-10.0'.	

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DRILLING LOG of WELL NO. SHL-20

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State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
225-	11	10.0'-12.0': SAND (SP): same as above, dry, with less staining.				4	Spl Spn Run 3:	
	12					3	10.0'-12.0'	
	13					4	1.1' recovery. OVA:	
	14					5	spoon and hole (0 ppm).	
	15						Collected archive sample.	
	16						Augered from 12.0'-15.0'.	
220-	17	15.0'-17.0': SAND (SP): wet at 15.2', fine to medium grained, heavily stained with rust (limonitic), 90% quartz, 10% mafics, <1% mica.				5	Spl Spn Run 4:	
	18					5	15.0'-17.0'	
	19					7	1.7' recovery. OVA:	
	20					6	spoon and hole (0 ppm).	
	21						Collected archive sample.	
	22						Augered from 17.0'-20.0'.	
215-	23	20.0'-22.0': SAND (SP): saturated, fine to coarse grained, no staining, subrounded to angular, 75% quartz, 25% mafics, <1% mica.				4	Spl Spn Run 5:	
	24					7	20.0'-22.0'	
	25					7	1.4' recovery. OVA:	
	26					6	spoon (5 ppm) and hole (50 ppm). (methane)	
	27						Collected archive sample.	
	28						Augered from 22.0'-25.0'.	
210-	29	25.0'-27.0': SAND (SP): gray-brown, saturated, fine to coarse grained, 85% quartz, 13% mafics, 2% pink feldspar, <1% mica, rounded to angular grains.				0	Spl Spn Run 6:	
	30					2	25.0'-27.0'	
	31					3	1.8' recovery. OVA:	
	32					4	spoon (4 ppm) and hole (50 ppm). (methane)	
	33						Collected archive sample.	
	34						Augered from 27.0'-30.0'.	
205-	35	30.0'-32.0': SAND (SP): gray-brown, saturated, fine to coarse grained, with little rounded gravel, 90% quartz, 10% mafics, <1% mica, rounded to angular grains.				1	Spl Spn Run 7:	
	36					3	30.0'-32.0'	
	37					3	1.7' recovery. OVA:	
	38					4	spoon (2 ppm) and hole (40 ppm). (methane)	
	39						Collected archive sample.	

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State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Corst.
	34						Augered from 32.0'-35.0'.	
200	35	35.0'-37.0': SAND (SP): gray-brown, saturated, fine to medium grained, 90% quartz, 10% mafics, <1% mica.				5	Spl Spn Run 8:	
	36					5	35.0'-37.0'	
	37					6	1.5' recovery. OVA:	
	38					7	spoon (3 ppm) and hole (>100 ppm). (methane)	
	39						Collected archive sample.	
	40	40.0'-42.0': SAND (SP): same as above, with few rounded pebbles of mafic material.					Augered from 37.0'-40.0'.	
195	41					0	Spl Spn Run 9:	
	42					3	40.0'-42.0'	
	43					5	1.5' recovery. OVA:	
	44					10	spoon (3 ppm) and hole (>100 ppm) (methane).	
	45	45.0'-47.0': SAND (SP): gray to tan, saturated, fine to coarse grained, 90% quartz, 10% mafic, <1% mica, rounded to angular grains.					Collected archive sample.	
190	46						Augered from 42.0'-45.0'.	
	47					11	Spl Spn Run 10:	
	48					11	45.0'-47.0'	
	49	48'-49': Cuttings are indicative of weathered granodiorite. 49.0'-54.0': DIABO-QUARTZITIC GNEISS: very hard, metamorphic, microcrystalline, with several high angle fractures and iron staining in fractures.				17	1.8' recovery. OVA:	
	50					25	spoon (3 ppm) and hole (80 ppm) (methane).	
	51						Collected archive sample.	
	52						Attempted to auger from 47.0'-50.0'.	
185	53	54.0'-59.0': DIABO-QUARTZITIC GNEISS: same as above.					Casing and split spoon refusal at 48'.	
	54						Top of bedrock at 48'.	
	55						Tri-cone roller bit used to drill from 48'-49'.	
180	56						Core Run 1: 49.0'-54.0'	
							Core Run 2: 54.0'-59.0'	

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
175	58 59 60 61 62 63 64	59.0'-64.0': <u>DIABO-QUARTZITIC GNEISS</u> : same as above. with an approximately 2' vertical fracture which has partially healed.					Core Run 3: 59.0'-64.0' CONSTRUCTION SUMMARY Well: Hole dia.: 10". screen/casing dia.: 4". slot size: 0.010". Stickup measured from ground surface to top of inner casing. All cuttings with head space readings above 10 ppm were containerized in 55-gallon drums.		

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DRILLING LOG of WELL No. SHL-21

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State MASSACHUSETTS Start Date 6/18/91
 Location FORT DEVENS Completion Date 6/19/91
 Drilling Firm E & E DRILLING Ground Elevation 257.93
 Type of Drill ACKER 82 Groundwater Depth
 Driller DON CAMPBELL at completion 40.60 ∇
 on 12/12/91 42.66 ∇
 Geologist ROBERT A. MEYERS Total Depth of Boring 53.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
257.93		Ground Surface					Stickup = 1.82	
	1	0.0'-0.1': <u>TOPSOIL (OL)</u> : organic material and sand; roots extend to 0.4'.				3	Spl Spn Run 1:	
						5	0.0'-2.0'	
	2	0.1'-2.0': <u>SAND (SP)</u> : medium brown, slightly moist, fine to coarse, with some fine to coarse gravel and trace of cobbles; all materials range from rounded to subangular, loose, non-cohesive, 60% quartz, 25% feldspars, 10% ferro-magnesians, with little silt and clay in matrix.				9	1.8' recovery. OVA:	
255	3					12	spoon, hole, and head space (0 ppm). Collected archive sample.	
	4						Augered from 2.0'-5.0'.	
	5	5.0'-7.0': <u>SAND (SP)</u> : light brown, moist, fine to coarse grained, loose, non-plastic, with little rounded (granite) gravel, angular to rounded, 80% clear quartz, 15% ferro-magnesians and mica, 5% feldspars.				5	Spl Spn Run 2:	
	6					7	5.0'-7.0'	
	7					9	1.2' recovery. OVA:	
250	8					13	spoon (0.1 ppm) and hole (0 ppm). Collected archive sample.	
	9						Augered from 7.0'-10.0'.	

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DRILLING LOG of WELL NO. SHL-21

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
245	11	10.0'-12.0': <u>SAND</u> (SM): light gray, dry, very fine to fine grained, loose, non-plastic, angular to subrounded, 90% quartz, 10% ferro-magnesians, mica, and feldspar.				5	Spl Spn Run 3:		
						8	10.0'-12.0'		
						10	1.2' recovery. OVA:		
	12					12	spoon (0 ppm) and hole (0.2 ppm).		
	13						Collected archive sample.		
240	14	15.0'-17.0': <u>SAND</u> (SM): same as above, fine to very fine grained.					Augered from 12.0'-15.0'.		
	15					3	Spl Spn Run 4:		
	16					3	15.0'-17.0'		
	17					5	1.5' recovery. OVA:		
						9	spoon (0.1 ppr) and hole (0 ppm).		
235	18	20.0'-22.0': <u>SAND</u> (SM): same composition as above, but slightly more finely grained, with some silt, slightly moist, no staining or inclusions.					Collected archive sample.		
	19						Augered from 17.0'-20.0'.		
	20					5	Spl Spn Run 5:		
	21					9	20.0'-22.0'		
	22					11	1.9' recovery. OVA:		
230	23	25.0'-27.0': <u>SAND</u> (SM): same as above, light gray to white, very slightly moist, with three (1/2") seams of tan silt, non-plastic, non-cohesive.				12	spoon (0.1 ppm) and hole (0 ppm).		
	24						Collected archive sample.		
	25						Augered from 22.0'-25.0'.		
	26					7	Spl Spn Run 6:		
	27					9	25.0'-27.0'		
225	28	30.0'-32.0': <u>SAND</u> (MH): light gray to white, dry, very fine, non-plastic, non-cohesive, 90% quartz, 10% ferro-magnesians, mica, and feldspar.				11	1.5' recovery. OVA:		
	29					15	spoon and hole (0 ppm).		
	30						Collected archive sample.		
	31						Augered from 27.0'-30.0'.		
	32					3	Spl Spn Run 7:		
	33					5	30.0'-32.0'		
						8	1.5' recovery. OVA:		
						11	spoon (0 ppm) and hole (0.4 ppm).		
							Collected archive sample.		

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State		Location		FORT DEVENS				Well	
MASSACHUSETTS								Const.	
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks		
	34						Augered from 32.0'-35.0'.		
	35	35.0'-37.0': SAND (MH): same as above.				5	Spl Spn Run 8:		
	36					10	35.0'-37.0'		
	37					15	1.7' recovery. OVA:		
	38					17	spoon and hole (0 ppm).		
220	39						Collected archive sample.		
	40	40.0'-40.6': SAND (MH): same as above, slightly moist.				6	Augered from 37.0'-40.0'.		
	41	40.6'-42.0': SAND (MH): same very fine sand composition as above, with silt, wet, moderately firm (cohesive) due to moisture content.				8			
	42	non-plastic; brown when wet, dries to light gray.				11	Spl Spn Run 9:		
215	43					13	40.0'-42.0'		
	44						1.9' recovery. OVA: hole and head space (0 ppm).		
	45	45.0'-47.0': SAND (MH): same as above, saturated.					Collected archive sample.		
	46						Water encountered at 40.6'.		
	47					3	OVA spiked at 2 ppm when spoon was opened.		
	48					3	Augered from 42.0'-45.0'.		
210	49					4	Spl Spn Run 10:		
	50					5	45.0'-47.0'		
	51						OVA: spoon (0.2 ppm) and hole (0 ppm).		
	52						Collected archive sample.		
205	53						No further sampling due to sands flowing into auger.		
							Sample (with duplicate) was taken for TOC analysis.		
							CONSTRUCTION SUMMARY		
							Well: Hole dia.: 10", screen/casing dia: 4".		
							slot size: 0.010 "		
							Material Qty.:		
							Filter Pk.: 800lbs.		
							Bert. Pel.: 15 dry gallons.		

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DRILLING LOG of WELL NO. SHL-21

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State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blew Count	Remarks	Well Const.
							Cem.: 1,316 dry lbs.. Cem./Bent.: 5%. Stickup measured from ground surface to top of inner casing.	

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DRILLING LOG of WELL No. SHL-22

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State MASSACHUSETTS Start Date 7/14/91
 Location FORT DEVENS Completion Date 7/23/91
 Drilling Firm E & E DRILLING Ground Elevation 219.58
 Type of Drill ACKER 82 Groundwater Depth
 Driller DON CAMPBELL at completion 8.50
 on 12/12/91 4.86
 Geologist ROBERT A. MEYERS Total Depth of Boring 129.6'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
219.58		Ground Surface					Stickup = 0.91	
	1	0.0'-1.2': <u>SAND</u> (SP): tan, damp, loose, medium to coarse grained, with little fine sand, trace rounded pebbles, roots, 90% quartz, 10% mafics.				2	Spl Spn Run 1:	
						2	0.0'-2.0'	
	2	1.2'-1.4': <u>SILT</u> (MH): medium brown, damp, loose, organic silt with fine sand, rounded to angular sand grains, 90% quartz, 10% mafics.				2	1.4' recovery. OVA:	
	3					2	spoon and hole (0 ppm), head space (2 ppm).	
	4						Collected archive sample.	
215	5	5.0'-5.8': <u>SILT</u> (MH): same as above, damp, compact, with some rounded pebbles; pebbles are crystalline, metamorphosed, and highly quartzitic.				22	Augered from 2.0'-5.0'.	
	6					37	Spl Spn Run 2:	
	7	5.8'-7.0': <u>SAND</u> (SP): medium to coarse, damp, compact, limonitic staining, trace roots, trace silt and clay, some rounded pebbles; pebbles are crystalline, metamorphosed, and highly quartzitic.				47	5.0'-7.0'	
	8					47	1.8' recovery. OVA:	
	9						spoon (5 ppm), hole (0 ppm), and head space (1.5 ppm). (methane)	
210							Collected archive sample.	
							Augered from 7.0'-10.0'.	

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State		MASSACHUSETTS		Location		FORT DEVENS		
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const
205	11	10.0'-12.0': SAND (SP): tan, loose, very fine to coarse, with some silt and trace gravel, trace limonitic staining, 90% quartz, 10% mafic, <1% mica.				3	Water at 8.5' BGS.	
	12					4	Sp1 Spn Run 3:	
	13					5	10.0'-12.0'	
	14					9	1.9' recovery. OVA: spoon and hole (0 ppm), head space (9.8 ppm).	
	15						Collected archive sample.	
200	16	15.0'-17.0': SAND (SP): saturated, loose, medium to coarse grained, 90% quartz, 10% mafic, angular to subrounded grains, with trace gravel.				1	Augered from 12.0'-15.0'.	
	17					2	Sp1 Spn Run 4:	
	18					4	15.0'-17.0'	
	19					5	1.7' recovery. OVA: spoon and hole (0 ppm), head space (2.5 ppm).	
	20						Collected archive sample.	
195	21	20.0'-22.0': SAND (SP): saturated, loose, very fine to coarse grained, with trace silt and gravel, 90% quartz, 10% mafic.				2	Augered from 17.0'-20.0'.	
	22					4	Sp1 Spn Run 5:	
	23					7	20.0'-22.0'	
	24					13	1.8' recovery. OVA: spoon and hole (0 ppm), head space (4.5 ppm).	
	25						Collected archive sample.	
190	26	25.0'-27.0': SAND (SP): same as above, saturated, loose, with no gravel, <1% mica.				7	Augered from 22.0'-25.0'.	
	27					7	Sp1 Spn Run 6:	
	28					11	25.0'-27.0'	
	29					11	2.0' recovery. OVA: spoon and hole (0 ppm), head space (2.8 ppm).	
	30						Collected archive sample.	
	31	30.0'-32.0': SAND (SP): same composition as above, gray, saturated, loose, fine to medium grained, with some coarse sand, trace silt and gravel.				7	Augered from 27.0'-30.0'.	
	32					5	Sp1 Spn Run 7:	
	33					7	30.0'-32.0'	
						8	2.0' recovery. OVA: spoon and hole (0 ppm), head space (3.6 ppm).	

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DRILLING LOG of WELL NO. SHL-22

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
185	34						Collected archive sample.		
	35					3	Augered from 32.0'-35.0'.		
	36	35.0'-37.0': SAND (SP): saturated, loose, coarse, 75% quartz, 15% mafics, 10% feldspar, with some gravel and some fine to medium grained sand; gravel composed of granitic and microcrystalline rocks.				8	Sp1 Spn Run 8:		
	37					8	35.0'-37.0'		
	38					12	1.7' recovery. OVA: spoon and hole (0 ppm), head space (3.8 ppm).		
180	39						Collected archive sample.		
	40	40.0'-42.0': SAND (SP): gray, saturated, loose, medium grained, angular, trace fine sand and rounded gravel, 95% quartz, 5% mafics.				7	Augered from 37.0'-40.0'.		
	41					7	Sp1 Spn Run 9:		
	42					11	40.0'-42.0'		
	43					7	1.7' recovery. OVA: spoon and hole (0 ppm), head space (6.2 ppm).		
175	44						Collected archive sample.		
	45	45.0'-47.0': No recovery.				4	Augered from 42.0'-45.0'.		
	46					3	Sp1 Spn Run 10:		
	47					4	45.0'-47.0'		
	48					6	No recovery due to flowing sands. OVA: spoon and hole (0 ppm).		
170	49						Augered from 47.0'-50.0'.		
	50	50.0'-52.0': No recovery.				3	Sp1 Spn Run 11:		
	51					15	50.0'-52.0'		
	52					35	No recovery due to flowing sands. The sample is being washed away		
	53					17	by water. OVA: spoon and hole (0 ppm).		
165	54						Augered from 52.0'-55.0'.		
	55	55.0'-57.0': SAND (SP): fine to coarse grained, with angular to rounded grains of 80% quartz, and 20% mafics, trace silt and gravel.				3	Sp1 Spn Run 12:		
	56					3	55.0'-57.0'		
						5	1.2' recovery. OVA: spoon and hole (0		

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DRILLING LOG of WELL NO. SHL-22

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State		Location		FORT DEVENS				
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Corst.
160	58						ppm). head space (0.5 ppm).	
	59						Collected archive sample.	
	60						The sand rose 10' into the casing and was then sampled.	
	61						The bottom of the casing is at 55' BGS.	
	62						Augered from 57.0'-63.0'.	
	63	63.0'-65.0': SAND (SP): gray, medium and coarse grained, with some fine sand/silt, some gravel, 80% quartz, 20% mafics.				32	Spl Spn Run 13:	
	64					15	63.0'-65.0'	
155	65					18	1.1' recovery. OVA:	
	66					22	spoon and hole (0 ppm). head space (4.5 ppm).	
	67						Collected archive sample.	
	68						Augered from 65.0'-73.0'.	
150	69							
	70							
	71							
	72							
	73	73.0'-75.0': SAND (SM): gray, saturated, firm, fine grained, with some rounded gravel and trace coarse sand, 80% quartz, 20% mafics.				32	Spl Spn Run 14:	
	74					26	73.0'-75.0'	
145	75					18	1.0' recovery. OVA:	
	76					18	spoon and hole (0 ppm). head space (6 ppm).	
	77						Collected archive sample.	
	78						(methane) Augered from 75.0'-83.0'.	
140	79							
	80							

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DRILLING LOG of WELL NO. SHL-22

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State		Location		FORT DEVENS				
MASSACHUSETTS								
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const
	81							
	82							
	83							
	84	83.0'-85.0': <u>SAND</u> (SM): gray, saturated, medium grained, angular, with trace fine sand, 90% quartz, 10% mafics.				12	Spl Spn Run 15:	
135	85					12	83.0'-85.0'	
	86	85.0'-115.0': <u>TILL</u> (SP): consists most probably of tight till, containing both gravel and cobbles.				16	0.6' recovery. OVA:	
	87					42	spoon and hole (0	
	88						ppm). head space (196	
	89						ppm).	
	90						(methane)	
	91						Collected archive	
	92						sample.	
	93						Some sand flowed back	
	94						into casing,	
	95						approximately 1'.	
130	96						Unable to sample	
	97						beyond 85'.	
	98							
	99							
	100							
	101							
	102							
	103							

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DRILLING LOG of WELL NO. SHL-22

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
115	105								
	106								
	107								
	108						Hit a large (9")		
	109						cobble at 108' BGS.		
110	110								
	111								
	112								
	113								
	114								
105	115								
	116	115.0'-120.0': <u>QUARTZO-FELDSPATHIC GNEISS</u> : with quartz seams, few open 45 degree angle fractures, mostly mechanical breaks and healed fractures, contains mica.					Bedrock at 115' BGS. Natural sand pack at 115' BGS due to cave in.		
	117						Unable to obtain a Geotechnical or TOC sample from within the screened interval (105'-115') due to increased grain size in that zone.		
	118						Core Run 1:		
	119						115.0'-120.0'		
100	120	120.0'-125.0': <u>QUARTZO-FELDSPATHIC GNEISS</u> : with mica, few open 45 degree angle fractures, mostly fractures healed with quartz or are mechanical breaks.					2.9' recovery.		
	121						Core loss from top of core.		
	122						Core Run 2:		
	123						120.0'-125.0'		
	124						4.6' recovery.		
95	125	125.0'-129.6': <u>QUARTZO-FELDSPATHIC GNEISS</u> : same as above.					Core Run 3:		
	126						125.0'-129.6'		
	127						1.7' recovery.		
							Core loss from bottom of hole.		

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DRILLING LOG of WELL NO. SHL-22

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State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
	128						CONSTRUCTION SUMMARY	
	129						Well: Hole dia.: 10".	
90							screen/casing dia.: 4".	
							slot size: 0.010".	
							Stickup measured from ground surface to top of inner casing.	

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DRILLING LOG of WELL No. SHL-23

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State MASSACHUSETTS Start Date 7/16/91
 Location FORT DEVENS Completion Date 7/17/91
 Drilling Firm E & E DRILLING Ground Elevation 240.37
 Type of Drill DIEDRICH D-50 Groundwater Depth
 Driller PAUL BARTH at completion 25.84 ∇
 on 12/12/91 24.11 ∇
 Geologist LISA HELTON Total Depth of Boring 35.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
240.37		Ground Surface					Stickup = 1.77	
240	1	0.0'-2.0': <u>SILT</u> (MH): medium brown, dry, non-plastic, loose, fine grained; little sand, light brown, medium brown, clasts.				4 6 8 18	Spl Spn Run 1: 0.0'-2.0' 1.0' recovery. OVA: spoon, hole, and head space (0 ppm). Collected archive sample. Augered from 2.0'-5.0'.	
235	5	5.0'-7.0': <u>SAND</u> (SP): gray-brown, low moisture, loose, medium grained, trace silt, organics throughout.				3 5 6 7	Spl Spn Run 2: 5.0'-7.0' 1.7' recovery. OVA: spoon, hole, and head space (0 ppm). Collected archive sample. Augered from 7.0'-10.0'.	

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DRILLING LOG of WELL NO. SHL-23

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
230	11	10.0'-12.0': SAND (SP): same as above.				4	Spl Sph Run 3:		
	12					7	10.0'-12.0'		
	13					7	1.7' recovery. OVA:		
	14					14	spoon, hole, and head space (0 ppm). Collected archive sample.		
	15						Augered from 12.0'-15.0'.		
225	16	15.0'-17.0': SAND (SP): same as above, except medium to coarse grained, loose to medium compactness.				4	Spl Sph Run 4:		
	17					7	15.0'-17.0'		
	18					11	1.0' recovery. OVA:		
	19					15	spoon, hole, and head space (0 ppm). Collected archive sample.		
	20						Augered from 17.0'-20.0'.		
220	21	20.0'-22.0': SAND (SW): same as above, except gravelly, moderate moisture.				9	Spl Sph Run 5:		
	22					12	20.0'-22.0'		
	23					14	1.0' recovery. OVA:		
	24					20	spoon, hole, and head space (0 ppm). Collected archive sample.		
	25						Augered from 22.0'-25.0'.		
215	26	25.0'-27.0': SAND (SW): gray-brown, wet, coarse grained, medium compactness, organics, gravelly.				10	Spl Sph Run 6:		
	27					17	25.0'-27.0'		
	28					17	1.2' recovery. OVA:		
	29	27.0'-30.0': SAND (SW): medium brown, wet, medium grained, some silt, non-plastic, gravelly.				20	spoon, hole, and head space (0 ppm). Collected archive sample.		
	30						Augered from 27.0'-30.0'.		
210	31	30.0'-35.0': SAND (SW): medium brown, wet, medium grained, some silt, non-plastic, gravelly.					OVA: hole and head space (0 ppm). Augered from 30.0'-35.0'.		
	32						OVA: hole and head space (0 ppm).		
	33								

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DRILLING LOG of WELL NO. SHL-23

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const	
	34						CONSTRUCTION SUMMARY Well: Hole dia.: 10". screen/casing dia.: 4". slot size: 0.010". Material Qty.: Filter Pk.: 600lbs. Bent. Pel.: 17.5 dry gallons. Cem.: 517 dry lbs.. Cem./Bent.: 5%. Stickup measured from ground surface to top of inner casing.		
	35								

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DRILLING LOG of WELL No. SHL-24

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State MASSACHUSETTS Start Date 7/19/91
 Location FORT DEVENS Completion Date 7/24/91
 Drilling Firm E & E DRILLING Ground Elevation 237.68
 Type of Drill ACKER 82 Groundwater Depth
 Driller DON CAMPBELL at completion 15.30 ∇
 on 12/12/91 13.87 ∇
 Geologist ROBERT A. MEYERS Total Depth of Boring 129.5'
 Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
237.68		Ground Surface					Stickup = 1.92	
	1	0.0'-0.6': <u>SILT</u> (MH): dark brown, dry, with fine sand and trace roots.	X			5	Sp1 Spn Run 1:	
						8	0.0'-2.0'	
	2	0.6'-2.0': <u>SAND</u> (SP): tan, dry, fine to coarse grained, angular, 95% quartz, 5% mafics.				2	1.8' recovery. OVA:	
						4	spoon, hole, and head space (0 ppm).	
235-	3						Collected archive sample.	
	4						Augered from 2.0'-5.0'.	
	5	5.0'-7.0': <u>SAND</u> (SP): dry, fine to coarse grained, subrounded to angular, with trace silt, 95% quartz, 5% mafics.				10	Sp1 Spn Run 2:	
	6					8	5.0'-7.0'	
	7					9	1.8' recovery. OVA:	
						12	spoon, hole, and head space (0 ppm).	
230-	8						Collected archive sample.	
	9						Augered from 7.0'-10.0'.	

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DRILLING LOG of WELL NO. SHL-24

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description		Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
225	11	10.0'-12.0': SAND (SP): dry, fine to coarse grained, subrounded to angular, with trace silt, 90% quartz, 10% mafics.					5	Spl Spn Run 3:	
							8	10.0'-12.0'	
							8	1.8' recovery. OVA:	
	12						11	spoon, hole, and head space (0 ppm).	
	13							Collected archive sample.	
220	14	15.0'-17.0': SAND (SP): tan, wet at 15', medium grained, some fine, trace coarse sand and gravel, limonitic staining.						Augered from 12.0'-15.0'.	
	15						4	Spl Spn Run 4:	
	16						4	15.0'-17.0'	
	17						7	1.2' recovery. OVA:	
	18						7	spoon, hole, and head space (0 ppm).	
215	19	20.0'-22.0': SAND (SP): same as above, saturated, no limonitic staining, <1% mica.						Collected archive sample.	
	20							Augered from 17.0'-20.0'.	
	21						4	Spl Spn Run 5:	
	22						7	20.0'-22.0'	
	23						14	1.9' recovery. OVA:	
210	24	25.0'-27.0': SAND (SP): tan, saturated, fine grained, trace coarse, angular to subangular, starting to flow, some silt, 95% quartz, 5% mafics.					11	spoon (0.5 ppm), hole and head space (0 ppm).	
	25							Collected archive sample.	
	26							Augered from 22.0'-25.0'.	
	27						4	Spl Spn Run 6:	
	28						4	25.0'-27.0'	
205	29	30.0'-32.0': SAND (SP): same as above, trace coarse grained sand, no medium grained, flowing.					8	1.6' recovery. OVA:	
	30						13	spoon, hole, and head space (0 ppm).	
	31							Collected archive sample.	
	32							Augered from 27.0'-30.0'.	
	33						6	Spl Spn Run 7:	
							11	30.0'-32.0'	
							11	1.5' recovery. OVA:	
							12	spoon, hole, and head space (0 ppm).	
								Collected archive sample.	

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DRILLING LOG of WELL NO. SHL-24

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.	
	34						Augered from 32.0'-35.0'.		
	35	35.0'-37.0': <u>SILT</u> (MH): tan, saturated, trace very fine sand, flowing, no inclusions.				0	Sp1 Spn Run 8:		
	36					0	35.0'-37.0'		
	37					0	1.8' recovery. OVA:		
	38					0	spoon, hole, and head space (0 ppm). Collected archive sample.		
200	39	40.0'-42.0': <u>SILT</u> (MH): same as above.					Augered from 37.0'-40.0'.		
	40					0	Sp1 Spn Run 9:		
	41					0	40.0'-42.0'		
	42					8	2.0' recovery. OVA:		
195	43					10	spoon, hole, and head space (0 ppm). Collected archive sample.		
	44						Augered from 42.0'-45.0'.		
	45					0	Sp1 Spn Run 10:		
	46					10	45.0'-47.0'		
	47	45.0'-47.0': <u>SAND</u> (SP): tan, saturated, very fine to fine grained, angular, flowing, 99% quartz, 1% mafic.				14	1.2' recovery. OVA:		
190	48					16	spoon, hole, and head space (0 ppm). Collected archive sample.		
	49						Augered from 47.0'-53.0'.		
	50								
	51	53.0'-55.0': No recovery due to flowing sands, saturated.				9	Sp1 Spn Run 11:		
185	52					13	53.0'-55.0'		
	53					24	No recovery due to fine flowing sands.		
	54					21	OVA: spoon, hole, and head space (0 ppm). Augered from 55.0'-63.0'.		
	55								
	56								

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DRILLING LOG of WELL NO. SHL-24

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State MASSACHUSETTS Location FORT DEVENS

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
180	58							
	59							
	60							
	61							
	62							
175	63	63.0'-65.0': SAND (SP): tan, saturated, very fine to fine grained, flowing, with some silt, 95% quartz, 4% mafic, 1% mica, limonitic staining.				13	Sp1 Spn Run 12:	
	64					21	63.0'-65.0'	
	65					19	0.9' recovery. OVA:	
	66					19	spoon, hole, and head space (0 ppm).	
	67						Collected archive sample.	
	68						Augered from 65.0'-73.0'.	
170	69							
	70							
	71							
	72							
165	73	73.0'-75.0': SAND (SP): tan, saturated, very fine to fine grained, flowing, with trace silt, limonitic staining.				14	Sp1 Spn Run 13:	
	74					11	73.0'-75.0'	
	75					14	1.3' recovery. OVA:	
	76					21	spoon, hole, and head space (0 ppm).	
	77						Collected archive sample.	
	78						Augered from 75.0'-83.0'.	
160	79							
	80							

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DRILLING LOG of WELL NO. SHL-24

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State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well	Const.
	81	83.0'-85.0': <u>SAND</u> (SP): gray to tan, saturated, very fine to fine grained, limonitic staining.							
	82								
155	83								
	84					13	Sp1 Spn Run 14:		
						13	83.0'-85.0'		
						13	0.9' recovery. OVA:		
	85					22	spoon, hole, and head		
	86						space (0 ppm).		
	87						Collected archive		
							sample.		
150	88	93.0'-95.0': <u>SILT</u> (MH): gray to tan, saturated, with some very fine to fine grained sand.					Augered from		
	89						85.0'-93.0'.		
	90								
	91								
	92								
145	93								
	94					16	Sp1 Spn run 15:		
						16	93.0'-95.0'		
	95					19	0.6' recovery. OVA:		
	96					24	spoon, hole, and head		
	97	No Geotechnical or TOC samples taken from 95'-114.5' (bedrock) due to split spoon refusal.					space (0 ppm).		
	98						Collected archive		
140	99						sample.		
	100								
	101								
	102								
135	103								

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DRILLING LOG of WELL NO. SHL-24

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State		Location		FORT DEVENS				
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
130	105							
	106							
	107							
	108							
	109							
	110							
	111							
	112							
125	113							
	114							
	115	114.5'-114.65': <u>GRANITIC CORBLE</u>					Core Run 1:	
	116	114.65'-119.5': <u>PHYLLITE</u> : gray. with mechanical breaks.					114.5'-119.5'	
	117						3.6' recovery. OVA: hole (0 ppm).	
	118						Monitoring well did not actually penetrate into the bedrock.	
120	119							
	120	119.5'-124.5': <u>PHYLLITE</u> : same as above, with a single vertical fracture from 123.8'-124.5'; slickensides along vertical fracture.					Core Run 2:	
	121						119.5'-124.5'	
	122						4.6' recovery.	
	123							
115	124							
	125	124.5'-129.5': <u>PHYLLITE</u> : same as above, no vertical fractures.					Core Run 3:	
	126						124.5'-129.5'	
	127						1.3' recovery. Bottom of core left in the hole.	

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State		MASSACHUSETTS		Location		FORT DEVENS		
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
110	128						CONSTRUCTION SUMMARY Well: Hole dia.: 10", screen/casing dia.: 4", slot size: 0.010". Stickup measured from ground surface to top of inner casing.	
	129							

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DRILLING LOG of WELL No. SHL-25

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State MASSACHUSETTS Start Date 7/17/91
 Location FORT DEVENS Completion Date 7/18/91
 Drilling Firm E & E DRILLING Ground Elevation 257.10
 Type of Drill DIEDRICH D-50 Groundwater Depth
 Driller PAUL BARTH at completion 24.00 ∇
 on 12/12/91 22.79 ∇
 Geologist WALTER KNOTTS Total Depth of Boring 35.0'

Lock #3217

Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	well Const.
257.10		Ground Surface					Stickup = 1.77	
255	1	0.0'-12.0': SAND (SP): light medium brown, damp, medium dense, fine to coarse grained, quartzose, trace feldspar and mica, occasional igneous and metamorphic rock fragments.				6	Spl Spn Run 1:	
						7	0.0'-2.0'	
						7	1.6' recovery. OVA:	
	2					8	spoon and hole (0 ppm).	
	3						Collected archive sample.	
	4						Augered from 2.0'-5.0'.	
	5					6	Spl Spn Run 2:	
	6					16	5.0'-7.0'	
	7					14	1.5' recovery. OVA:	
250	8					14	spoon and hole (0 ppm).	
	9						Collected archive sample.	
							Augered from 7.0'-10.0'.	

USATHAMA, ARMY CORPS OF ENGINEERS

Ecology and Environment, Inc.

Buffalo, New York

DRILLING LOG of WELL NO. SHL-25

Page 2 of 3

State		Location		FORT DEVENS				
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const.
245	11	12.0'-29.0': SAND (SP): medium brown, moist, medium dense, very fine to fine, little silt, trace clay, quartzose, subangular to subrounded, trace mica.				5	Sp1 Spn Run 3:	
	12					8	10.0'-12.0'	
	13					9	1.7' recovery. OVA:	
	14					10	spoon and hole (0 ppm).	
	15						Collected archive sample.	
	16					6	Augered from 12.0'-15.0'.	
240	17					10	Sp1 Spn Run 4:	
	18					9	15.0'-17.0'	
	19					7	1.7' recovery. OVA:	
	20						spoon and hole (0 ppm).	
	21					5	Collected archive sample.	
235	22					7	Augered from 17.0'-20.0'.	
	23					9	Sp1 Spn Run 5:	
	24					14	20.0'-22.0'	
	25						1.6' recovery. OVA:	
	26					4	spoon and hole (0 ppm).	
230	27					7	Collected archive sample.	
	28					7	Augered from 22.0'-25.0'.	
	29					14	Sp1 Spn Run 6:	
	30						25.0'-27.0'	
	31	29.0'-35.0': SAND AND SILTY CLAY (SP): medium brown, wet, dense, trace rock fragments - possibly till.				7	1.8' recovery. OVA:	
225	32					14	spoon and hole (0 ppm).	
	33						Collected archive sample.	
							Augered from 27.0'-34.5'	
							OVA: hole (0 ppm).	

USATHAMA, ARMY CORPS OF ENGINEERS

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DRILLING LOG of WELL NO. SHL-25

Page 3 of 3

State		MASSACHUSETTS		Location		FORT DEVENS			
Elev.	Depth	Description	Lithology	Sample No. and	Symbol	Blow Count	Remarks	Well Const	
	34						Bent. Pel.: 10 dry gallons.		
	35						Cem.: 329 dry lbs.. Cem./Bent.: 5%.		
							Stickup measured from ground surface to top of inner casing.		

USATHAMA, ARMY CORPS OF ENGINEERS

Ecology and Environment, Inc.

Buffalo, New York

SOIL BORING LOG						Study Area: Shepley's Hill Landfill		
Client: AEC			Project No. 7005-04			Boring No.: SHM-93-01A		
Contractor: New Hampshire Boring			Date Started: 01/21/93			Completed: 01/21/93		Method: HSA
Ground Elev.: 235.5 ft.			Soil Drilled: 26 ft.			Total Depth: 26 ft.		Casing Size: 6.25 ID
Logged by: RRR			Checked by: DSP			Groundwater Below Ground: 20 ft.		
Screen: 10 (ft)		Riser: 18 (ft)	Diam.: 4.0" (ID)		Material: Sch 40PVC	Protection: Mod.D		Page 1 of 1
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. — REC.	PID (ppm)	SOIL-ROCK DESCRIPTION	BLOWS\6-IN.	COMMENTS	
2	S-1	0'-2'	1.5 ----- 2.0	BKG	0'-1.4' SAND, poorly graded, medium, 10% coarse, 10% fine, 0'-2' gravel subrounded, tannish brown, medium dense (SP) 1.4'-1.5' SAND, poorly graded, fine, 0-2% silt, subangular, dry, medium dense, tannish brown (SP)	6-13-13-14	Start 0940	
6	S-2	5'-7'	1.7 ----- 2.0	BKG	SAND, poorly graded, fine, 15% medium, subangular, dry, very loose, light brown (SP)	3-4-5-5		
12	S-3	10-12	1.8 ----- 2.0	BKG	SAND, similar to above (SP)	3-4-4-6		
16	S-4	15-17	1.6 ----- 2.0	BKG	0'-1.5 SAND, similar to above, banding (SP) 1.5'-1.6' and in shoe, SAND, well graded, medium to coarse sand and gravel, subangular to angular, damp, loose, light brown (SW)	3-5-9-12	Change	
20	S-5	20-22	1.6 ----- 2.0	BKG	0'-0.6' SAND, poorly graded, fine to medium, rounded, very loose, wet, dark brown (SP) 0.6'-1.6' gravely SAND, poorly graded, coarse, 10% medium, very loose, subrounded, wet, reddish brown (SP)	2-4-4-6 2-4-4-6	Water at 20' bgs TOC Analytical collected	
26	S-6	25 - 25.5	0.6 ----- 2.0	BKG	Sandy SILT, rock in shoe, cobbles of low grade metamorphosed rock in silt (SP-SM)	5-50 for 4"	Rock in shoe	
28					BOE = 26' bgs, 1245 hours, 1/21/93			Refusal on rock

ABB Environmental Services, Inc.

SOIL BORING LOG						Study Area: Shepley's Hill Landfill					
Client: AEC			Project No. 7005-04			Boring No.: SHM-93-10C					
Contractor: New Hampshire Boring			Date Started: 02/09/93			Completed: 2/12/93		Method: HSA/Case/Core			
Ground Elev.: 247.5 ft.			Soil Drilled: 36.5 ft.			Total Depth: 59.5 ft.		Casing Size: 6"			
Logged by: RRR			Checked by: DSP			Groundwater Below Ground: 29.5 ft.					
Screen: 10 (ft)		Riser: 45 (ft)		Diam.: 4.0" (ID)		Material: Sch 40PVC		Protection: Mod.D		Page 1 of 2	
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. REC.	PID (ppm)	SOIL-ROCK DESCRIPTION				BLOWS\6-IN.		COMMENTS
2	S-1	0-2	1.5 ----- 2.0	BKG	SAND, poorly graded, medium, 5% fine, 5% coarse, rounded, dry, medium dense, 7.5 yr 6/3 light brown, aeolian, /glacial outwash (SP)				16-10-12-12		
4											
6	S-2	5-7	1.6 ----- 2.0	BKG	SAND, poorly graded, similar to above but loose, dry (SP)				6-5-5-6		
8											
10											
12	S-3	10-12	1.4 ----- 2.0	BKG	SAND, similar to above (SP)				4-6-6-4		
14											
16	S-4	15-17	1.6 ----- 2.0	BKG	SAND, similar to above but very loose, dry (SP)				4-4-4-5		
18											
20											
22	S-5	20-22	1.7 ----- 2.0	BKG	SAND, similar to above (SP)				4-4-6-6		
24											
26	S-6	25-27	1.9 ----- 2.0	BKG	SAND, similar to above, medium dense, 10 yr 6/3 pale brown (SP)				7-10-14-19		
28											
											Water at 29' bgs

ABB Environmental Services, Inc.

SOIL BORING LOG					Study Area: Shepley's Hill Landfill		
Client: AEC		Project No. 7005-04		Boring No.: SHM-93-10C			
Contractor: New Hampshire Boring		Date Started: 02/09/93		Completed: 02/12/93		Method: HSA/Case/Core	
Ground Elev.: 247.5 ft.		Soil Drilled: 36.5 ft.		Total Depth: 59.5 ft.		Casing Size: 6"	
Logged by: RRR		Checked by: DSP		Groundwater Below Ground: 29.5 ft			
Screen: 10 (ft)		Riser: 45 (ft)	Diam.: 4.0" (ID)	Material: Sch 40PVC	Protection: Mod.D	Page 2 of 2	
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. REC.	PID (ppm)	SOIL-ROCK DESCRIPTION	BLOWS\6-IN.	COMMENTS
30	S-7	30-32	1.8	BKG	Sand to silty sand, poorly graded, fine, subrounded, medium dense, wet, 10% silt, 7.5 yr 5/6 strong brown, coarse piece of subangular gravel at 1.4' (SP-SM)	16-13-13-12	
32			2.0				
34	S-8	35 - 36.5	1.5	BKG	Similar to above, weathered rock frags near bottom of spoon (SP-SM)	WOR/1/50-4"	
36			2.0				
38					Bedrock		
40					36.5' will core rest of hole; see attached core logs.		
42							
44							
46							
48							
50							
52							
54							
56							
58							

ROCK CORING LOG

Project: Fort Devens		Study Area: SHL		Project No. 02005-04	
Client: USATHAMA		Driller's Name: G. LAVITT		Logged by: RRR	Checked by: Ground Elev.:
Drilling Contractor: NHB		Protection Level: MODIFIED D		Rig Type: B-53	Start Date: 2-9-93 Finish Date: 2-12-93
Drilling Method: HQ 6" CASING : CORE : OVERDRAM 5 7/8"		P.L.D. (eV): FID OVA		Casing Size: 6"	Auger Size: —
Bit type/size: HQ 15 = .21' 0.5 = .32'		Bit Use: NEW		Core Interval (to/from)(ft): 36.5 → 41.5	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Cove Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
37.0			X 20°	F					7		X = MECHANICAL / = NATURAL (SOLUTION STRESS EROSIONAL) LOW TO MEDIUM GRADE META-PELITIC SILTSTONES. SECONDARY QUARTZ FOUND IN BOTH HALVES AND OPEN FRACTURES. BEDDING APPEARS TO BE DIPPING @ 45-55°. ROCK IS BLACK/GRAY WHEN WET. DRILLS TO A DARK GREY. PRIMARILY SILICICLASTIC W/ SECONDARY QUARTZ AND SULFIDES ALONG FRACTURES.
37.5			X	F					7		
38			X	F					6		
38.5	4.8 5.0		10-40° / solution	F		4.1 5.0	82%	GOOD	7		
39			X 80°	F					5		
39.5			X	F					5		
40			X	F					5		
40.5			X	F					7		
41			X 6°	F					7		
41.5			X	F					7		

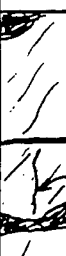


ROCK CORING LOG

Project: Fort Devens		Study Area: SUM-93-100		Project No. 07005-07	
Client: USATHAMA		Driller's Name:		Logged by: RER	Checked by:
Drilling Contractor:		Protection Level:		Rig Type: B 53	Start Date:
Drilling Method:		P.I.D. (eV):		Casing Size:	Auger Size:
Bit type/size: HQ		Bit Use: HQ		Core Interval (to/from)(ft): 41.5 - 46.5 RUN # 2	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Cove Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
42	Run # 2		X	F					5		<p>META-PELTIC SILTSTONES. LOW TO MEDIUM GRADE SILICICLASTIC W/ SECONDARY QUARTZ AND SULFIDES ALONG FRACTURES AND SOLUTION CAVITIES. FRACTURES MIMIC BEDDING PLANES PRIMARILY.</p> <p>GETTING GOOD RETURN ON CIRCULATION WATER DESPITE EXTENSIVE SOLUTION CAVITIES</p>
43	5.0 / 5.0		1 45°	E					5		
44			SOLUTION FRAC. + CAVITIES	W		5.0	100%	Exc.			
45			X	F					6		
45			SOLUTION	W					5		
46			1 30°	W							
46			1 60°	W					6		
46.5			X	F							

ROCK CORING LOG

Project: Fort Devens		Study Area: SHM. 93.100		Project No.	
Client: USATHAMA		Driller's Name:		Logged by:	Checked by:
Drilling Contractor:		Protection Level:		Rig Type: B. 53	Start Date: 2.9.93
Drilling Method:		P.T.D. (eV): FID/OVA		Casing Size:	Auger Size:
Bit type/size: HQ		Bit Use:		Core Interval (to/from)(ft): 46.5 → 51.5 Run # 3	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Core Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
47	46.5 ↓ 51.5		X (F)	10.5" (W) HEALED FRAC SOLUTION		5.0	5.0 5.0 = 100%	EXC	6	MOTTLED LIGHT TO DARK GREY	METAPELITIC SILTSTONE LOW TO MEDIUM GRADE. GROWING MORE COMPETENT w/ DEPTH SULFIDES AND SECONDARY QUARTZ ALONG FRACTURE PLANES
48	5.0 5.0								7		SOLUTION CAVITY CONTAINING SILICASTIC LOST WATER AT THIS POINT
49									8		
50			X (F)						7		
51			X (F)								
51.5				8.10" (W)					8		HEALED FRACTURES ALONG BEDDING PLANES. SECONDARY QUARTZ

ROCK CORING LOG

Project: Fort Devens		Study Area: SUM-93-10C		Project No.	
Client: USATHAMA		Driller's Name:		Logged by:	Checked by: Ground Elev.:
Drilling Contractor:		Protection Level:		Rig Type:	Start Date: Finish Date:
Drilling Method:		P.I.D. (eV):		Casing Size:	Auger Size:
Bit type/size:		Bit Use:		Core Interval (to/from)(ft): 51.5 → 56.5	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Cove Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
52	Run # 4		150°	x					7		SAME AS PREVIOUS CORE
53	5.0 5.0		150°	x		5.0	100%	EXC.	5		
54			150°	x					7		
55			150°	x					7		
56			150°	x					7		
56.5			150°	x							

ROCK CORING LOG

Project: Fort Devens		Study Area: SWM-93-10C		Project No. 07005-04	
Client: USATHAMA		Driller's Name:		Logged by: RLR	Checked by:
Drilling Contractor:		Protection Level:		Rig Type: B-53	Start Date: 2-9-93
Drilling Method:		P.I.D. (ft): FID/OVA		Casing Size: 6"	Finish Date: 2-12-93
Bit type/size:		Bit Use:		Core Interval (to/from)(ft): 56.5 - 59.5 3 FT	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Core Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
57	Run # 5 (RLR)		x	F					7		META PELITIC SILTSTONE FOLIATION BECOMING NEARLY VERTICAL IN MIDDLE OF THE SAMPLE ROCK IS MOTTLED WHITE-GRAY SILICICLASTIC IN ORIGIN CONTAINING BOTH PRIMARY AND SECONDARY QUARTZ
58	3.0 3.0					3'	100%	EXL	7		
59			x	F					7		
59.5			x	F							

SOIL BORING LOG						Study Area: Shepley's Hill Landfill		
Client: AEC			Project No. 7005-04			Boring No.: SHM-93-18B		
Contractor: New Hampshire Boring			Date Started: 02/04/93			Completed: 02/08/93		Method: HSA
Ground Elev.: 235.7 ft.			Soil Drilled: 93.5 ft.			Total Depth: 93.5 ft.		Casing Size: 6.25" ID
Logged by: RRR			Checked by: DSP			Groundwater Below Ground: 14 ft.		
Screen: 10 (ft)		Riser: 80 (ft)	Diam.: 4.0" (ID)		Material: Sch 40PVC	Protection: Mod.D	Page 1 of 4	
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. REC.	PID (ppm)	SOIL-ROCK DESCRIPTION		BLOWS\6-IN.	COMMENTS
2	S-1	0'-2'	1.3 ----- 2.0	BKG	SAND, poorly graded, medium to coarse, 5-10% ifne, subangular, loose, sample is dry but entirely frozen, 7.5 yr 7/2 pinkish gray, glacial outwash, aeolan (SP)		31-21-4-3	Change at 15.5 ft.
6	S-2	5'-7'	1.2 ----- 2.0	BKG	SAND, poorly graded, fine to medium, 1-2% silt, subrounded, medium dense, dry, 7.5 yr 7/2 pinkish gray, glacial outwash (SP)		11-16-27-23	
12	S-3	10-12	1.3 ----- 2.0	BKG	SAND, similar to above (SP) At 1.0' SAND is banded with silty sand, fine, loose, 2.5 yr 4/6 yellowish red, moist, resembles liesgang banding (SP-SM)		6-6-6-13	
16	S-4	15-17	1.5 ----- 2.0	BKG	0'-0.5' SAND, well graded, medium to coarse, 15-20% fine, 10% silt, medium dense, wet, 10 yr 4/4 dark yellowish brown (SW-SM) 0.5'-1.5' SAND, poorly graded, medium, 5% coarse, 5% fine, medium dense, wet, 10 yr 6/3 pale brown (SP)		6-8-6-13	
22	S-5	20-22	1.8 ----- 2.0	BKG	SAND, poorly graded, medium, 5% coarse, 5% fine, medium dense, wet, 10 yr 6/3 pale brown (SP)		6-10-12-13	
26	S-6	25-27	1.7 ----- 2.0	BKG	SAND, poorly graded, similar to above (SP)		WOR to 18"/9	

ABB Environmental Services, Inc.

SOIL BORING LOG						Study Area: Shepley's Hill Landfill		
Client: AEC			Project No. 7005-04			Boring No.: SHM-93-18B		
Contractor: New Hampshire Boring			Date Started: 02/04/93			Completed: 02/08/93		Method: HSA
Ground Elev.: 235.7			Soil Drilled: 93.5 ft.			Total Depth: 93.5		Casing Size: 6.25" ID
Logged by: RRR/LEF			Checked by: DSP			Groundwater Below Ground: 14'		
Screen: 10 (ft)		Riser: 80 (ft)		Diam.: 4.0" (ID)		Material: Sch 40PVC	Protection: Mod.D	Page 2 of 4
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. --- REC.	PID (ppm)	SOIL-ROCK DESCRIPTION	BLOWS\6-IN.	COMMENTS	
32	S-7	30-32	2.0 ----- 2.0	BKG	SAND, poorly graded, similar to above (SP)	WOH 1/2/5	SP	
34								
36	S-8	35-37	2.0 ----- 2.0	BKG	SAND, poorly graded, similar to above except 5 yr 6/4 reddish brown (SP)	3-8-12-22	SP	
38								
40								
42	S-9	40-42	0.0 ----- 2.0	BKG	Residual sand in spoon was similar to above (SP)	6-6-11-16	Sampled and drilled with 4 1/4" augers to 40'. Hole blew in to 35' bgs. Try to add head of water. Adding water was ineffective. Will telescope 3" casing inside of augers and procede from 40'. Decide to make another attempt with augers using twine to keep connections watertight.	
44								
46	S-10	45-47	0.7 ----- 2.0	BKG	SAND, poorly graded, similar to above (SP)	7/12/50-4		
48								
50								
52	S-11	50-52	0.0 ----- 2.0	BKG	Soils are running out of spoon when we are retrieving it	8/12/24/30	1' of sand heaved up inside of augers. Sand is flowing out of spoon when it is retrieved.	
54								
56	S-12	55-57	0.7 ----- 2.0	BKG	SAND, similar to above (SP)	9/15/22/24	Sample mostly represents soils which have heaved into augers.	
58								
60	S-13	58-60	0.0 ----- 2.0	BKG	No recovery, sands are running out of spoon	6/6/9/13		

SOIL BORING LOG						Study Area: Shepley's Hill Landfill					
Client: AEC			Project No. 7005-04			Boring No.: SHM-93-18B					
Contractor: New Hampshire Boring			Date Started: 02/04/93			Completed: 02/08/93		Method: HSA			
Ground Elev.: 235.7 ft.			Soil Drilled: 93.5 ft.			Total Depth: 93.5		Casing Size: 6.25" ID			
Logged by: RRR/LEF			Checked by: DSP			Groundwater Below Ground: 14 ft.					
Screen: 10 (ft)		Riser: 80 (ft)		Diam.: 4.0" (ID)		Material: Sch 40PVC		Protection: Mod.D		Page 3 of 4	
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. — REC.	PID (ppm)	SOIL-ROCK DESCRIPTION				BLOWS\6-IN.	COMMENTS	
62					No spoon attempted					2/4/93 2/5/93	
64											
66											
68											
70	S-14	69-71	0.9 ----- 2.0	BKG	SAND, poorly graded, fine, 15% medium, subangular, medium dense, wet, 10 yr 5/3 brown, glacial outwash (SP)				4/10/19/24		
72											
74											
76	S-15	74-76		BKG	SAND, similar to above but medium dense to dense (SP)				6/18/31/49	2/5/93 2/8/93	
78											
80	S-16	78-80	0.8 ----- 2.0	BKG	SAND, similar to above. At 0.1' and 0.3' there are 0.1' thick bands of SAND, medium to coarse, well graded, 20% fines, 5% silt, subrounded to rounded, medium dense, wet, 10 R 4/6 red (SW-SP)				10/15/29/29		
82											
84	S-17	83-85	1.8 ----- 2.0	BKG	SAND, poorly graded, fine to medium, subrounded, loose, wet, 7.5 yr 5/4, brown, glacial outwash (SP)				3/2/7/15		
86											
88											
	S-18	88-90	1.4 ----- 2.0	BKG	SAND, similar to above, medium dense (SP)				23/18/24/29		

SOIL BORING LOG					Study Area: Shepley's Hill Landfill				
Client: AEC			Project No. 7005-04			Boring No.: SHM-93-18B			
Contractor: New Hampshire Boring			Date Started: 02/04/93			Completed: 02/08/93		Method: HSA	
Ground Elev.: 235.7 ft.			Soil Drilled: 93.5			Total Depth: 93.5 ft.		Casing Size: 6.25" ID	
Logged by: RRR/LEF			Checked by: DSP			Groundwater Below Ground: 14 ft.			
Screen: 10 (ft)		Riser: 80 (ft)		Diam.: 4.0" (ID)		Material: Sch 40PVC		Protection: Mod.D	
Page 4		of 4							
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. — REC.	PID (ppm)	SOIL-ROCK DESCRIPTION			BLOWS\6-IN.	COMMENTS
92									
94					Refusal at 93.5'-Cuttings indicate bedrock-metamorphosed schistose rock				
96									
98									
100									
102									
104									
106									
108									
110									
112									
114									
116									
118									
120									

SOIL BORING LOG					Study Area: Shepley's Hill Landfill		
Client: AEC		Project No. 7005-04		Boring No.: SHM-93-22C			
Contractor: New Hampshire Boring		Date Started: 02/11/93		Completed: 02/25/93		Method: Drive/Wash	
Ground Elev.: 217.9		Soil Drilled: 115 ft.		Total Depth: 135 ft.		Casing Size: 6"	
Logged by: LET		Checked by: RRR		Groundwater Below Ground: 5.9 ft.			
Screen: 10 (ft)		Riser: 127 (ft)		Diam.: 4.0" (ID)	Material: Sch 40PVC	Protection: Mod.D	
Page 1		of 1					

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. — REC.	PID (ppm)	SOIL-ROCK DESCRIPTION	BLOWS\6-IN.	COMMENTS
1					No split-spoons collected (see soil boring log for SHL-22 installed by Ecology and Environment)		
115					Bedrock at 115' bgs, see core logs for rock descriptions		

ROCK CORING LOG

Project: Fort Devens		Study Area: SHL		Project No. 7005-04	
Client: USATHAMA		Driller's Name: G. Trombly		Logged by: J. Snowden	Checked by: Ground Elev.: --
Drilling Contractor: New Hampshire Boring		Protection Level: Level D		Rig Type: Mobile B	Start Date: 2/19/93 Finish Date: 2/25/93
Drilling Method: 6.0" casing and HX rock core		P.I.D. (eV):		Casing Size: 6.0"	Auger Size:
Bit type/size: HX		Bit Use:		Core Interval (to/from)(ft): 115.0' to 120.5' R-1	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Cove Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
115			X	F			2.5 1.9		7 min		X - mechanical / - natural W - weathered Meta pelitic siltstone w/ apparent quartz/quartzite intrusions in bedded and open fractures. The bedding and majority of fractures are dipping @ ~ 50°
116									5 min	Greenish Gray net	
117			/	W					5 min		
118	5.0						2.0		5 min		
119	5.0		X	F					5 min		
120			X	F			0.6		4 min		
121		End of R-1	X	F			3.5 5.0				

ROCK CORING LOG

Project: Fort Devens		Study Area: SKL		Project No. 7005-04	
Client: USATHAMA		Driller's Name: G. Twombly		Logged by: J. Snowden	Checked by:
Drilling Contractor: New Hampshire Boring		Protection Level: Level D		Rig Type: Model B-57	Start Date: 2/19/93
Drilling Method: 6.0" ID casing and 4X rock core		P.I.D. (eV):		Casing Size: 6.0"	Auger Size:
Bit type/size:		Bit Use:		Core Interval (to/from)(ft): 120.0' to 125.0' R-2	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Core Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
120									Spin		X-mechanical break /-natural fracture Similar to R-1
121									4 min	Grayish Green wet	
122	5.0		X Healed Frac.			4.8'			3 min	Light Grey dry	
123	5.0		X	F					4 min		
124			X	F							
125			X	F					5 min		
			End of R-2	W							

ROCK CORING LOG

Project: Fort Devens		Study Area: JHL		Project No. 7005-04	
Client: USATHAMA		Driller's Name: G. Twombly		Logged by: J. Snowden	Checked by:
Drilling Contractor: New Hampshire Boring		Protection Level: Level D		Rig Type: Mobile 3-57	Start Date: 2/19/93
Drilling Method: 6.0" casing and HX rock core		P.I.D. (eV):		Casing Size: 6.0"	Finish Date: 2/25/93
Bit type/size:		Bit Use:		Core Interval (to/from)(ft): 125.0' to 130.0' R-3	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Cove Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
125		X	X	F					3min		X-mechanical break Similar to R-1
126		X	X	F					4min		
127	5.0 5.0	X	X	F		5.0	100%	Excellent	4min		
128		X	X	F					5min		
129		X	X	F					3min		
130		End of R-3		F							

ROCK CORING LOG

Project: Fort Devens		Study Area: SHL		Project No. 7005-04	
Client: USATHAMA		Driller's Name: G. Trownsby		Logged by: J. Snowden	Checked by:
Drilling Contractor: New Hampshire Boring		Protection Level: Level D		Rig Type: Model B-57	Start Date: 2/19/93
Drilling Method: 6.0" casing and HX rock core		P.I.D. (eV):		Casing Size: 6.0"	Finish Date: 2/25/93
Bit type/size: HX		Bit Use:		Core Interval (to/from)(ft): R-4 130'-135'	

Depth (feet) Below GRD Sort.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Core Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
130			x						4		x-mechanical break Similar to R-1 Greenish Gray wet Heavy Dry
131			x						5		
132	4.9' 5.0'		x			4.9	100%	Excellent	4		
133			x						4		
134			x						4		
135			x								Bottom of boring at 135'

SOIL BORING LOG						Study Area: Shepley's Hill Landfill	
Client: AEC			Project No. 7005-04			Boring No.: SHB-93-01X	
Contractor: New Hampshire Boring			Date Started: 01/25/93			Completed: 01/25/93	
Ground Elev.: 235.5 ft.			Soil Drilled: 25 ft.			Total Depth: 25 ft.	
Logged by: LET			Checked by: RRR			Groundwater Below Ground: 19 ft.	
Screen: N/A (ft)		Riser: N/A (ft)		Diam.: N/A (ID)		Material: N/A	
Protection: Mod.D		Page 1		of 1			
DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	PEN. — REC.	PID (ppm)	SOIL-ROCK DESCRIPTION	BLOWS\6-IN.	COMMENTS
0-5	(1)				SAND, medium , dry, fill, 10 yr 5/4 yellowish brown, 15% sand		
5-10	(2)				SAND, fine-medium, dry, yellowish brown		
10-15	(3)			BKG	SAND, fine-medium, dry, yellowish brown		
15-20	(4)				Same		Loosened up at 19' (Water??)
20-25	(5)				Same		Started to scratch at 24' bgs
25-26	(6)				Same Material		
30					BOB 25' bgs		
40							
50							
60							
70							

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Drilling Log

Project Fort Devens 923074 Owner USAEC

Location SHEPLEY'S HILL W.O. Number _____

Well Number SHP-43-10D Total Depth 56.2' Diameter 10" - Overburden
1.87" - Bedrock

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. 4 in Length 39.5' Type Steel

Drilling Company Maher Drilling Method HSA / NA Core

Driller Jeff Quinn Log By Bob Kretz Date Drilled 11/8/93

Sketch Map

Notes

Depth (Feet)	Graphic Log	Headspace (PID / FID)	Sample Number	Description/Soil Classification (Color, Texture, Structures)
0-1.5'				SAND, trace ORGANICS, SLIGHTLY CLAYEY, MEDIUM GRAINED, SLIGHTLY GRAVELLY, MODERATELY SORTED, BROWN, LOOSE, MOIST
1.5'-5'		4 ppm	2/4/4/9	SAND, MEDIUM GRAINED, SLIGHTLY GRAVELLY, MODERATELY SORTED, BROWN, MOIST
5'-35'		0 ppm	4/4/9/9	SAND, VERY LIGHT BROWN, FINE GRAINED, WELL SORTED, LOOSE, MOIST
25'		0 ppm		

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Drilling Log

Project FEET DEVEN'S 92307.4 Owner USAEC

Location SHEDDEN'S HILL W.O. Number _____

Well Number SHP-13-10D Total Depth 56.2' Diameter 1.8" OVERBURD
1.8" BEDROCK

Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. 4" Length 39.5' Type STEEL

Drilling Company MAHER Drilling Method HSA / UX CODE

Driller JEFF G. WILSON Log By R. KATZ Date Drilled 11/8/93

Sketch Map

Notes

Depth (Feet)	Graphic Log	Headspace (PID / FID)	Sample Number	Description/Soil Classification (Color, Texture, Structures)
				35' WEATHERED BEDROCK FRAGMENTS
30			44/45	
				36.1' - 56.2' Phyllite
				FOLIATED AT ~70°, NUMEROUS
				FRACTURES IN FIRST TWO FEET
35		Oppm		FRACTURES ARE NEARLY PERPENDICULAR
				TO FOLIATIONS, ABUNDANT IRON STAINS
				ALONG FRACTURES. MINOR SILICA
				BANDING ~ 1/16" WIDTH, 49.0'-49.5'
40				SMALL FRACTURE ZONE W/ SANDY
				CLAY DEPOSITS IN FRACTURES
		FRACTURES ~10"		
45		Oppm		
50				
		NUMEROUS FRACTURES		

Project FORT DEVENS Study Area SHERLEY'S HILL

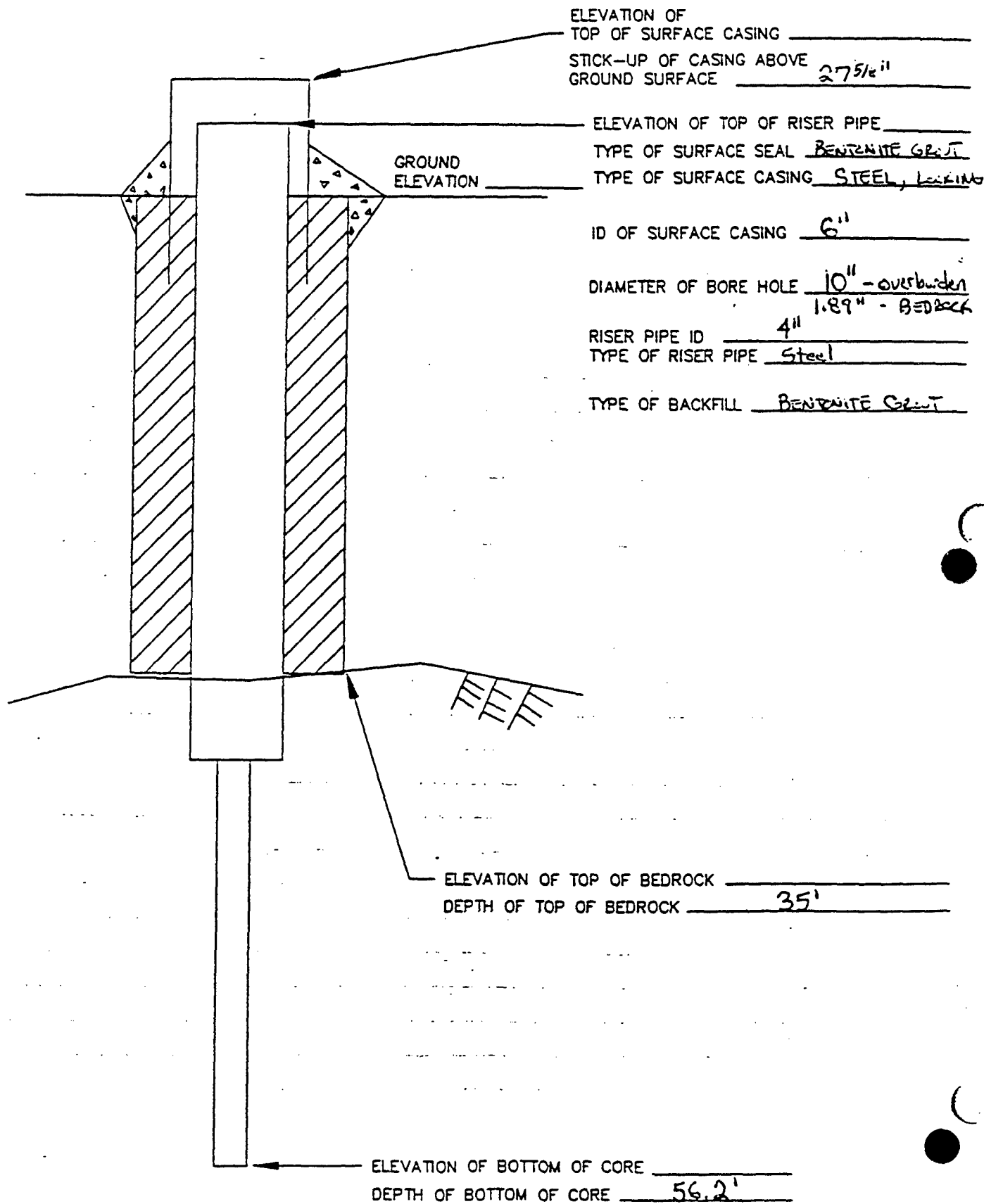
Driller MATHEW JIM ASIT

Project # 92307.4 Boring # SHP-43-10D

Drilling Method ASA / NA CORE

Field Geologist M. GARD
R. KRATZ Date Installed 11/2/93

Development Method PUMP, WATER



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Drilling Log

Project FERT DEVENS 92307.4 Owner USAEC
Location SITEPLEY'S HILL W.O. Number _____
Well Number SHR-93-ICE Total Depth 55.7' Diameter 1.89" - PERM
Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. 4" Length 37.5' Type STEEL
Drilling Company MAHER Drilling Method HSA, 1.89" X CASE
Driller JIM ASH Log By B. KEATZ, M. GARD Date Drilled 11/1/93

Sketch Map
Notes

Depth (Feet)	Graphic Log	Headspace (PID / FID)	Sample Number	Description/Soil Classification (Color, Texture, Structures)
	7/1/1			
	...	Oppm		
	...			0'-1' CLAYEY SAND, DARK BR, FINE
	...		2/1/34	GRAINED, WELL SORTED, LOOSE,
5	...	Oppm	X	ORGANIC RICH, MOIST
	...			
	...			
10	...	Oppm	X	
	...			
	...			
15	...	Oppm	X	
	...		1/2/3/3	
	...			
	...			1'-29' SAND VERY LIGHT BROWN,
	...			FINE GRAINED, WELL SORTED,
20	...	Oppm	X	LOOSE, MOIST
	...		2/3/4/5	25.5' CROSS BEDS
	...			
	...			
25	...	Oppm	X	
	...		4/4/4/2	
	...			

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Drilling Log

Project FULT DEJENS 923-7.4 Owner USAEC
Location SHEPHERD'S HILL W.O. Number _____
Well Number SHP-93-DE Total Depth 55.7' Diameter 1.25" OVERBOLT
Surface Elevation _____ Water Level: Initial _____ 24-hrs. _____
Screen: Dia. _____ Length _____ Slot Size _____
Casing: Dia. 4" Length 37.5' Type STEEL
Drilling Company M.H.H.R. Drilling Method HSA NA COLE
Driller: Jim Asst Log By R. KENTZ M. GARD Date Drilled 11/1/93

Sketch Map

Notes

Depth (Feet)	Graphic Log	Headspace (PID / FID)	Sample Number	Description/Soil Classification (Color, Texture, Structures)
30		Oppm	AAA/3	29' - 35' VERY SILTY SAND, LIGHT BROWN, VERY FINE GRAINED, WELL SORTED, LOOSE, SATURATED CABLE AT 31' AND 34'
35		Oppm ABUNDANT FRACTURES		35' BEDROCK, BEGIN CORING
40		Oppm		
45		Oppm		35' - 55.7' PHYLLITE, FOLIALED AT ~ 60, NUMEROUS VERTICAL FRACTURES IN TOP 1.5' NUMEROUS FRACTURES AT 45° IN OPPOSING DIRECTIONS TO FOLIATIONS ABUNDANT IRON STAINS ALONG FRACTURES, MINOR SELICK BANDING ~ 1/16" WIDTH
50		Oppm		

Project FORT DEVENS Study Area SHERREY'S HILL

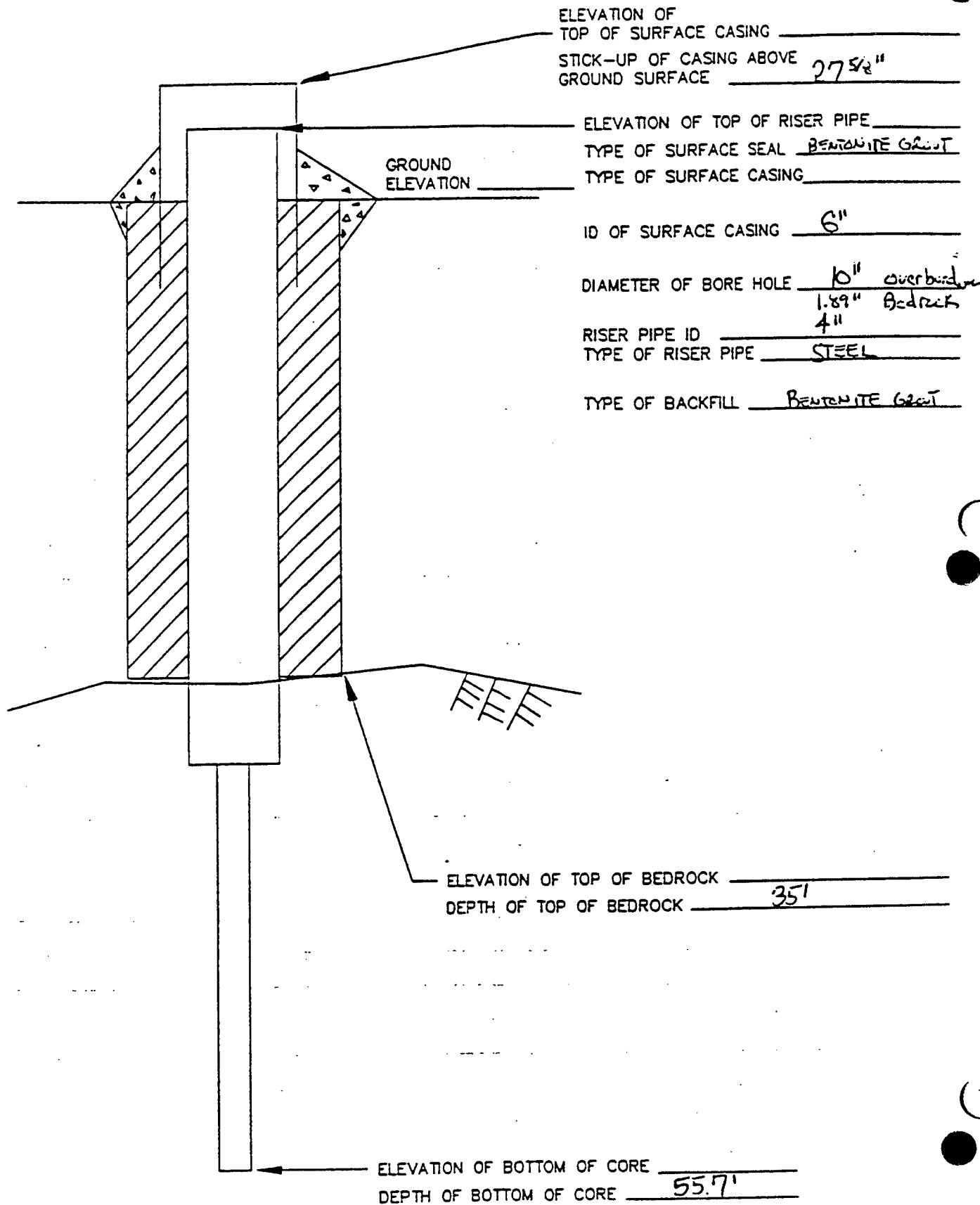
Driller MAYER, JEFF O. W. N.

Project # 92307.4 Boring # SHP-93-10E

Drilling Method HSA, 1.89" NX CASE

Field Geologist R. KATZ Date Installed 11/1/93

Development Method Pump, WATERBY



WELL INSTALLATION DIAGRAM

WELL NO.: SHM-93-01A

PROJECT NAME: FORT DEVENS 1A SITES

DATE INSTALLED: 1/21/93

PROJECT NO.: 7005-04

DRILLING METHOD: HSA

WATER ELEV.: 220.6

GROUND ELEVATION: 241.7'

CASING ID: 6.25"

DATE: June 21, 1993

WELL CASING ELEVATION: 243.40'

RIG GEOLOGIST: Rod Rustad

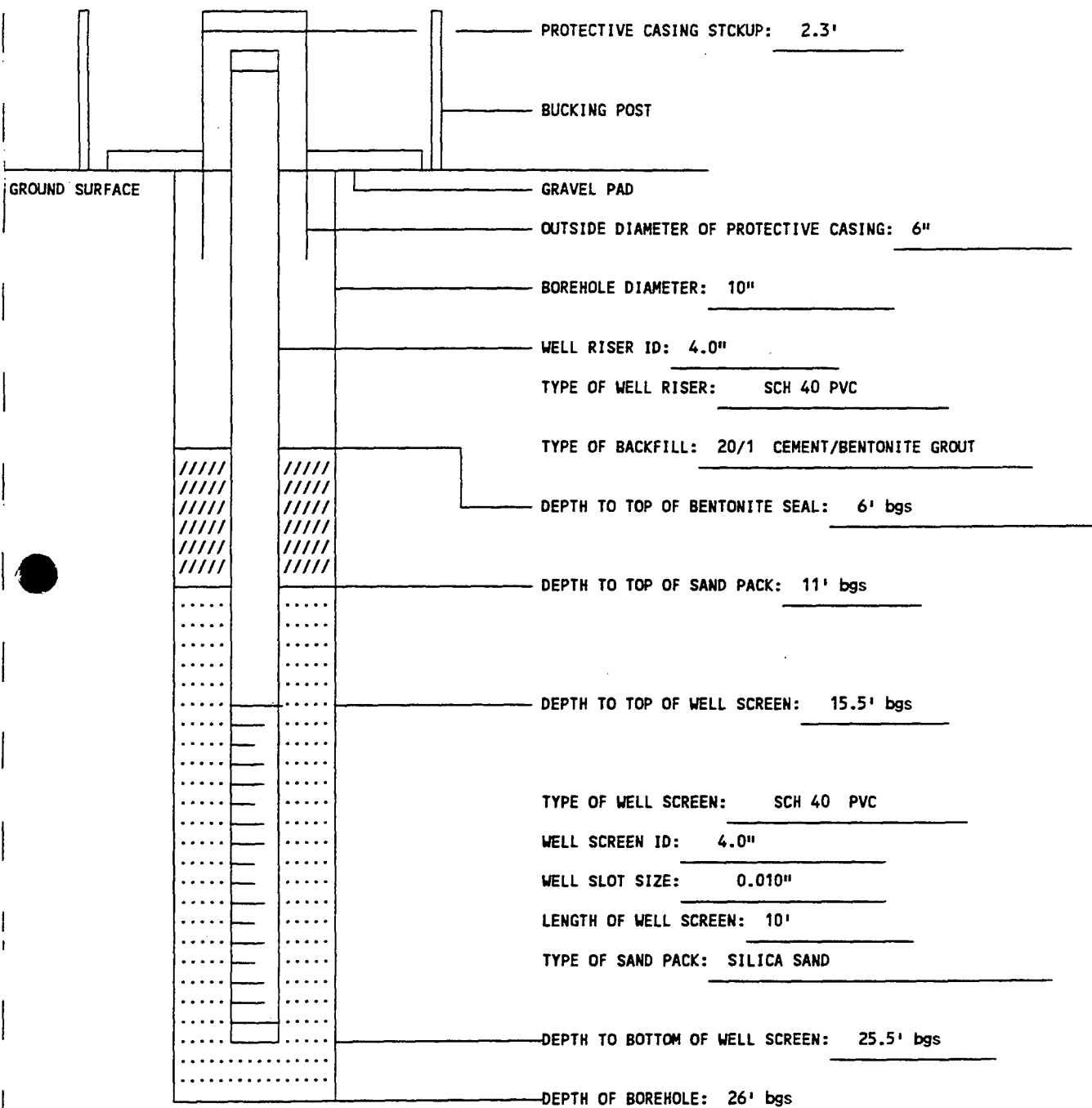


ABB ENVIRONMENTAL SERVICES, INC.

WELL INSTALLATION DIAGRAM

WELL NO.: SHM-93-10C

PROJECT NAME: Fort Devens FS/1A

DATE INSTALLED: 02/12/92

PROJECT NO.: 7005-04

DRILLING METHOD: Case/Core

WATER LEVEL: 218.32

GROUND ELEVATION: 247.1'

CASING ID: 6" / 5 5/8" in rock

DATE: June 21, 1993

WELL CASING ELEVATION: 248.79'

RIG GEOLOGIST: Rod Rustad

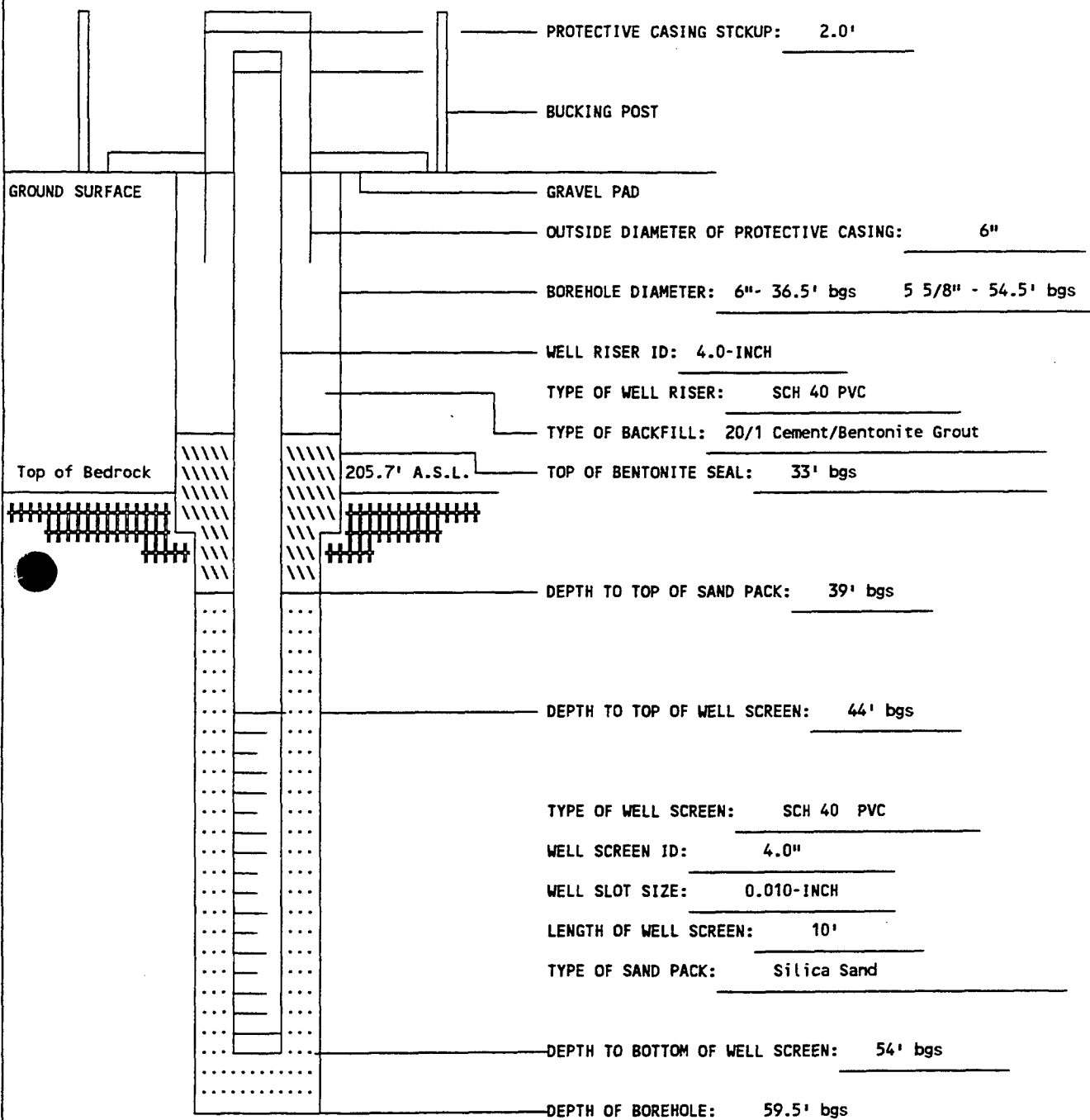


ABB ENVIRONMENTAL SERVICES, INC.

WELL INSTALLATION DIAGRAM

WELL NO.: SHM-93-188

PROJECT NAME: FORT DEVENS 1A SITES

DATE INSTALLED: 2/10/93

PROJECT NO.: 7005-04

DRILLING METHOD: Drive/Wash HSA

WATER ELEV.: 218.79

GROUND ELEVATION: 236.2'

CASING ID: 3"/6.25"

DATE: June 21, 1993

WELL CASING ELEVATION: 238.38'

RIG GEOLOGIST: Nelson Bretton

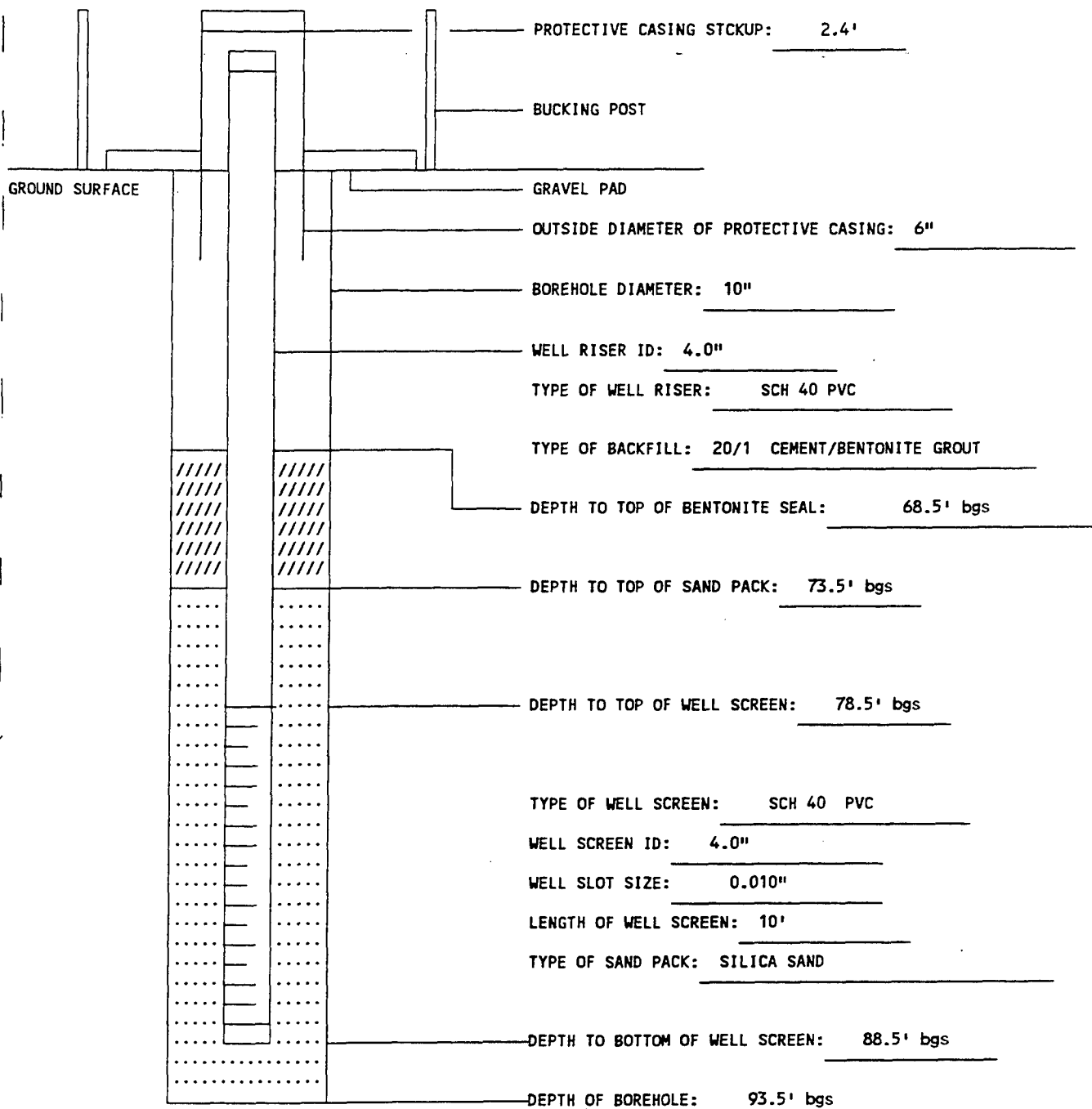


ABB ENVIRONMENTAL SERVICES, INC.

WELL INSTALLATION DIAGRAM

WELL NO.: SHM-93-22C

PROJECT NAME: Fort Devens FS/1A

DATE INSTALLED: 02/24/93

PROJECT NO.: 7005-04

DRILLING METHOD: Wash/Drive Casing

WATER LEVEL: 211.41

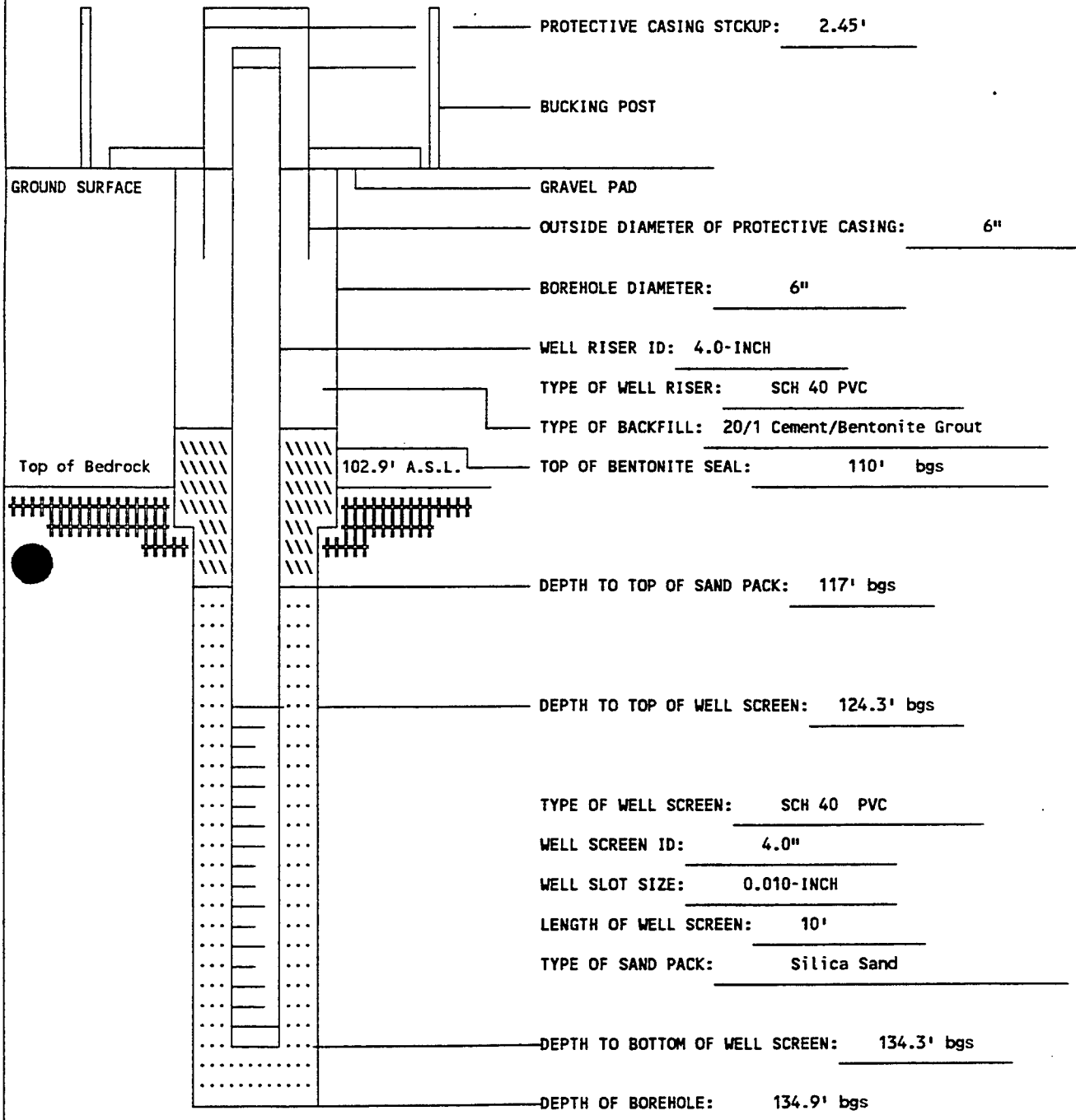
GROUND ELEVATION: 217.9'

CASING ID: 6"

DATE: June 21, 1993

WELL CASING ELEVATION: 219.76'

RIG GEOLOGIST: Lori Truesdale



WELL INSTALLATION DIAGRAM

WELL NO.: SHM-93-24A

PROJECT NAME: FORT DEVENS 1A SITES

DATE INSTALLED: 1/20/93

PROJECT NO.: 7005-04

DRILLING METHOD: HSA

WATER ELEV.: 220.49

GROUND ELEVATION: 235.5'

CASING ID: 6.25"

DATE: June 21, 1993

WELL CASING ELEVATION: 237.53'

RIG GEOLOGIST: Rod Rustad

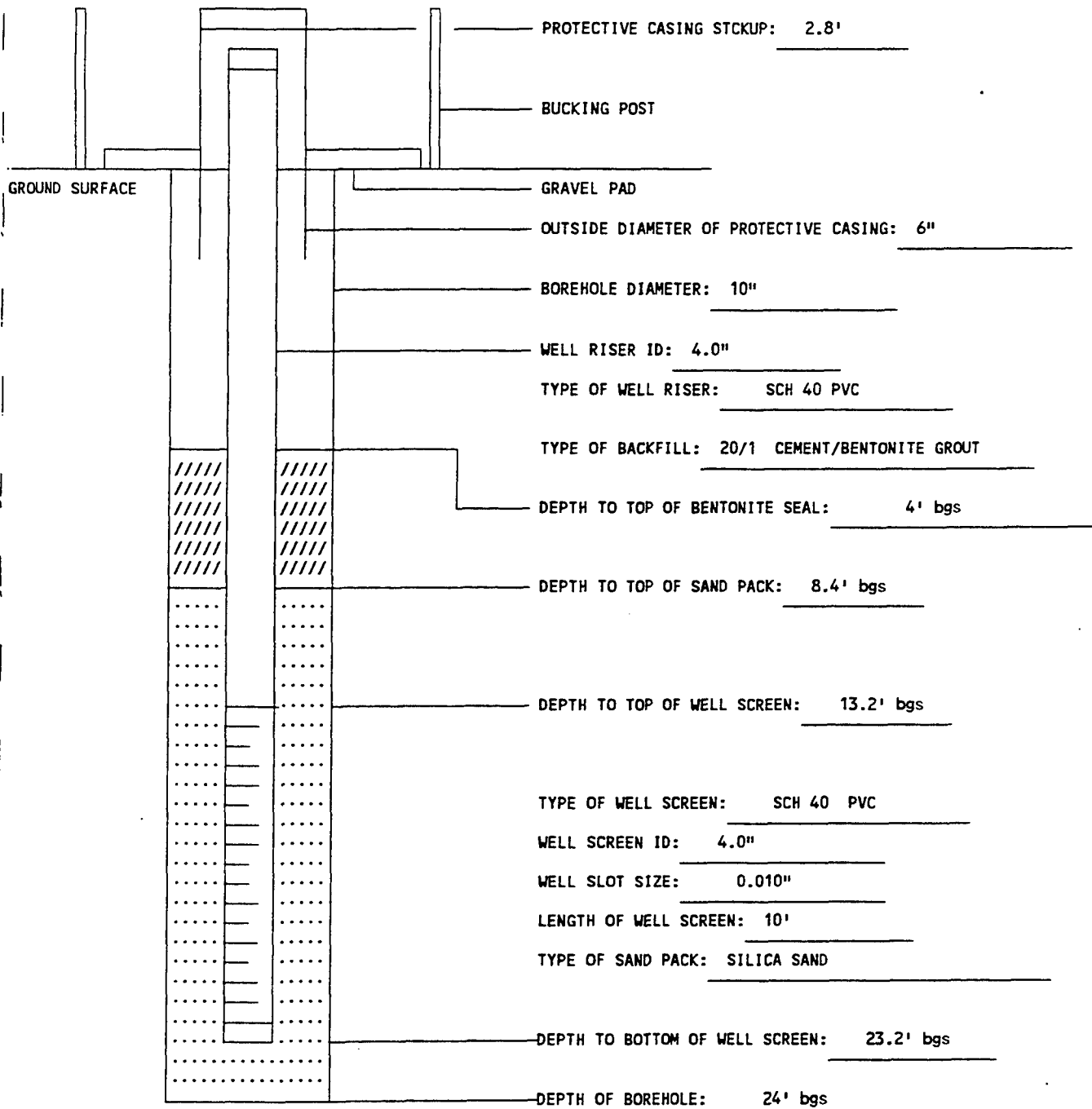


ABB ENVIRONMENTAL SERVICES, INC.

SOIL BORING LOG

Client: <u>USAF C</u>		Project No. <u>08712-04</u>		Study Area: <u>SHL - LANDFILL CONC.</u>	
Contractor: <u>D.L. MAHER</u>		Date Started: <u>6.26.95</u>		Boring No.: <u>SHB-95-26X</u>	
Method: <u>HSA</u>		Casing Size: <u>4 1/4" I.D.</u>		Protection: <u>MODIFIED</u>	
Ground Elev.: <u></u>		Soil Drilled: <u>49' (SAMPLED TO 51')</u>		Completed: <u>6.27.95</u>	
Logged by: <u>RRR</u>		Checked by: <u></u>		PI Meter: <u>TE/0VM</u>	
Screen: <u>N/A (ft.)</u>		Riser: <u>N/A (ft.)</u>		Total Depth: <u>51'</u>	
		Diam: <u>N/A (ID)</u>		Below Ground: <u>13.3 (6.27.95)</u>	
		Material: <u>N/A</u>		Page 1 of 3	

NOTE: REFERENCE SAMPLE COLLECTED FROM EVERY SPOON UNLESS NOTED.

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	2" O.D. SBOR 140# HAMMER BLOW COUNTS	WELL DATA
0		0		1.5	0.0	0-0.7 SAND, WELL GRADED, COARSE TO FINE, 5% GRAVEL, <5% SILT SUBROUNDED TO TOUCHED, LOOSE DRY, REDDISH TAN (SW)	(SW)	2	START 1300 6.26.95
2	S-1	2		2.0	0.0	0.7-1.5 SAND, POORLY GRADED, FINE, 15% MEDIUM, <5% SILT LOOSE, DRY, LIGHT YELLOW TAN. (SP)	(SP)	4 5 13	
4		4		1.5	0.0	SAND, POORLY GRADED, MEDIUM 10-15% FINE, SUBROUNDED TO SUBANGULAR, <5% FINES, LOOSE, DRY GRAYISH TAN. SILTY FINE SANDS LAYER FROM 4.7-4.75' BGS THIN LAMINAE BEDDING VISIBLE THROUGHOUT SPOON	(SP)	5 5 6	1325
6	S-2	6		2.0	0.0				
8									
10	S-3	9		1.4	0.0	SILTY SAND, POORLY GRADED, FINE, 10-20% SILT, WET, MEDIUM DENSE LIGHT BROWN. 0.01' THICK SILT LENS AT 10' BGS. SLIGHTLY COARSER SAND IMMEDIATELY ABOVE THE SILT LENS	(SP) SM	10 10 12 10	WET 1340
12		11		2.0	0.0				
14									
16	S-4	14		1.6	0.0	SAND, POORLY GRADED, FINE, 5% COARSE, 5-10% SILT, WET. VERY LOOSE, & LIGHT BROWN	(SP) SM	WOR 2 1	1355
18		16		2.0	0.0				
20	S-5	18		1.8	0.0	AFTER AUGERING TO 20' BGS SAND HEAVES TO 18' BGS WILL HAVE TO ADD WATER TO SUPPRESS HEAVES		2 2	
		21		2.0	0.0	SAND, POORLY GRADED, FINE, <5% FINES, 5% COARSE MEDIUM, WET VERY LOOSE. (PD) LIGHT BROWN TO TAN. "SPECKS" OF IRON STAINING VISIBLE THROUGHOUT SAMPLE	(SP)	2 2 6	1420

WOR = WEIGHT OF RODS

SOIL BORING LOG:

Study Area: SHL - LANDFILL CONS.

Boring No.: SHB-95-26X

Client: USAEC

Project No. 08712-04

Protection: MODIFIED D

Contractor: D.L. MAHER

Date Started: 6-26-95

Completed: 6-27-95

Method: HSA

Casing Size: 4 1/4" 1.1

PI Meter: TE-ORM

Ground Elev.:

Soil Drilled: 49' BGS (SAMPLED TO 51')

Total Depth: 51'

Logged by: RRR

Checked by:

Below Ground: 13.3 6-27-95

Screen: — (ft.)

Riser: — (ft.)

Diam: — (ID)

Material: —

Page 2 of 3

REFERENCE SAMPLE COLLECTED FROM ALL SPOONS
UNLESS OTHERWISE NOTED 2" O.D. SPOON

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	BLOW COUNTS	WELL DATA
	S-5 CONT	19 21				SEE PREVIOUS PAGE			
22									
24	S-6	24 26		1.6 2.0	0.0	ADDING WATER TO AGGERS NO HEAVE SAND, POORLY GRADED, FINE, <5% FINES, <5% MEDIUM, WET, VERY LOOSE TO LOOSE, LIGHT BROWN	(SP)	3 6 4 2	1455
26									
28									
30	S-7	29 31		1.5 2.0	0.0	29-29.5 - SAND SIMILAR TO S-6 29.5-30.5 - KNIFE EDGE CONTACT SAND, POORLY GRADED, FINE, 5-10% MEDIUM, <5% FINES, WET, V. LOOSE GREY, ANGULAR TO SUBANGULAR,	(SP)	2 4 4 8	1515
32									
34	S-8	34 36		1.8 2.0	0.0	0-1.1: SAND, POORLY GRADED, SIMILAR TO 29.5-30.5 SAMPLE BUT WITH SEVERAL 0.05" THICK BROWN SAND (FINE) LENSES. 4-5 35.1' BGS - SILT LENS, BLuish GREY, SLIGHTLY PLASTIC 35.1-35.8 - SAND, POORLY GRADED FINE, GREY SIMILAR TO ABOVE (34-35.1)	(SP) (ML) (SP)	8 9 6 2	1535
36									
38									
40	S-9	39 41		1.3 2.0	0.0	39-39.5 - SAND, POORLY GRADED, FINE GREY SIMILAR TO ABOVE. LOOSE-V. LOOSE	(SP)	2 4 10 10	1555

SOIL BORING LOG:

Client: USAEC	Project No. 08712.04	Study Area: SHL - LANDFILL CONS.
Contractor: D.L. MAHER	Date Started: 6.26.95	Boring No.: SHB. 95. 26X
Method: HSA	Casing Size: 4 1/4" I.D.	Protection: MODIFIED D
Ground Elev.: 	Soil Drilled: 49' BGS (SAMPLES TO 51')	Completed: 6.27.95
Logged by: RRC	Checked by: 	PI Meter: TE/OMM
Screen: — (ft.)	Riser: — (ft.)	Total Depth: 51'
Diam: — (ID)	Material: —	Below Ground: 13.3
Page 3 of: 3		

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	WELL DATA
42	S-9 CDLT	39 41		1.3 2.0	0.0	39.3 - 39.5 - SANDS, POORLY GRADED, MEDIUM, 10-15% FINE, < 5% FINES, WET, LOOSE, REDDISH TAN, ANGULAR SUBANGULAR TO SUBROUND.	SP	
44	S-10	44 46		0.9 2.0	0.0	39.5 - 40.3 - SANDS, POORLY GRADED, MEDIUM, 20% FINE, < 5% FINES, WET, LOOSE, GREY, SUBANGULAR	SP	
46								
48						STILL ADDING WATER TO AUGERS TO SUPPRESS PRESSURE HEAD		
50	S-11	49 51		1.2 2.0	0.0	SAND, POORLY GRADED, FINE, < 5% FINES, WET, LOOSE TO MEDIUM DENSE, GREYISH GREEN	SP	
52						B.O.E = 51' BGS (SPOON) 49' BGS (AUGER) 1645 COMPLETED 6.26.95 0800 6.27.95 BEGIN PULLING AUGERS AND GROUTING. Σ = 13.3' 1000 - GROUTING COMPLETE 13 BAGS CEMENT 1 BAG BENTONITE POWDER TRM.E PLACED		

SOIL BORING LOG:

Study Area: SHL LANDFILL CONSOLIDATION

Boring No.: SHP-95-27X

Client: USAEC

Project No. 08712-04

Protection: MODIFIED D

Contractor: S.L. MAHER

Date Started: 6-27-95

Completed: 6-28-95

Method: DRIVE + WASH

Casing Size: 3" I.D. CASING

PI Meter: TE-00M

Ground Elev.:

Soil Drilled: 39.5

Total Depth: 40.5

Logged by: RRR

Checked by:

Below Ground: 14.2' (6-28-95)

Screen: (ft.)

Riser: (ft.)

Diam: (ID)

Material:

Page 1 of: 3

REFERENCE SAMPLE COLLECTED FROM EVERY SPOON.

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH 3" CASING ON-TO-OPENING BLOWS	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	2" SPOON 140 lb HAMMER BLOW COUNTS	WELL DATA SEE WELL CONST. DING.
2	S-1	3	1.3 2.0	0.0	SAND POORLY GRADED, FINE, 10-20% MEDIUM, < 5% SILT DRY, LOOSE, SUBROUNDED, YELLOW TAN LAMWAE BEDDING THROUGHOUT	SP	1 2 4 3	1215
4		14						
4		17						
4		17						
6	S-2	5	0.9 2.0	0.0	SAND, POORLY GRADED, FINE, 5% MEDIUM, < 5% FINES, MOIST (DUE SOLELY TO WASHING) LOOSE, VERY LIGHT TAN, SUBANGULAR	SP	3 6 3 9	1315
8		7						
8		16						
8		17						
10	S-3	10	0.9 2.0	0.0	10-10.6 - SANDS SIMILAR TO S-2 10.6-10.8 - SANDS, POORLY GRADED, FINE, 10-15% SILT, MOIST, LOOSE, BROWN	SP SP SM	6 7 9 9	1340
12		12			10.8-10.9 - SANDS, POORLY GRADED, FINE, < 5% FINES, DRY, LOOSE, LIGHT GREY TAN, SUBROUNDED	SP		
14		15						
14		18						
14		14						14.2' (6-28-95)
16	S-4	15	1.4 2.0	0.0	15-15.2 - SANDS, POORLY GRADED, FINE 10-15% MEDIUM, < 5% FINES, WET LOOSE LIGHT BROWN, SUBROUNDED TO SUBANGULAR	SP	5 6 5 6	1405
16		17			15.2-15.7 - SANDS, FINE, 5-10% SILT LOOSE, WET, SUBROUNDED, MEDIUM BROWN	SP/SM		
18		10			15.7-16.4 - SANDS TO SILTY SAND, POORLY GRADED, FINE, 5-15% SILT, LOOSE WET, GREY, SUBANGULAR, MICACEOUS.	SP SM		
18		9						
20		10						

SOIL BORING LOG

Study Area: SHL - LANDFILL COAS.

Boring No.: SHP. 95. 27X

Client: USAEC

Project No. 08712-04

Protection: MOS D

Contractor: D. L. MAUER

Date Started: 6-27-95

Completed: 6-28-95

Method: D + W

Casing Size: 3" ID

PI Meter: TE / GUN

Ground Elev.:

Soil Drilled: 39.5

Total Depth: 40.5

Logged by: RRR

Checked by:

Below Ground: 14.2 (6-28-95)

Screen: (ft.)

Riser: (ft.)

Diam: (ID)

Material:

Page 2 of 3

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	CASING BLOW COUNTS	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	2" SPOON BLOW COUNTS	WELL DATA
20	S-5	20	10	1.2	0.0	SAND, POORLY GRADED, FINE, 5-10% SILT, WET, LOOSE, MEDIUM BROWN, SUBANGULAR. (DISTINCTLY DIFFERENT IN COLOR FROM GREY SAND AT 16')	SP	5 5 6 7	1450
22		22	12	2.0					
24			12						
24			13						
24			14						
26	S-6	25	15	1.2	0.0	SAND, POORLY GRADED, FINE, 5%-10% MEDIUM, < 5% SILT, WET, LOOSE, LT BROWN, GRADING TO GREY, SUBROUNDED	SP	4 6 5 6	1450
26		27	22	2.0					
28			24						
28			27						
30			28						
30	S-7	30	30	1.2	0.0	SAND, POORLY GRADED, FINE, < 5% SILT, WET, LOOSE, GREY	SP	8 4 8 7 5 8 4 5	
32		32	39	2.0	RR	30.7 - 30.9 - SAND, POORLY GRADED, FINE (BUT COARSER THAN ABOVE) < 5% SILT, WET, LOOSE, WET RED FeO ₂ STAINING.	SP		
34			44		RR	30.9 - 31.2 - SAND, POORLY GRADED, FINE, 5-10% SILT, LOOSE, WET, GREY	SP SM		
34			49						
36	S-8	35	51	1.5	0.0	SAND, POORLY GRADED, SIMILAR TO 30.9 TO 31.2 FT BGS GRADING TO SALTY SAND, FINE, 20% SILT, LOOSE, WET, GREY	SP	8 8 5 4	
36		37	54	2.0			SM		
38			78						

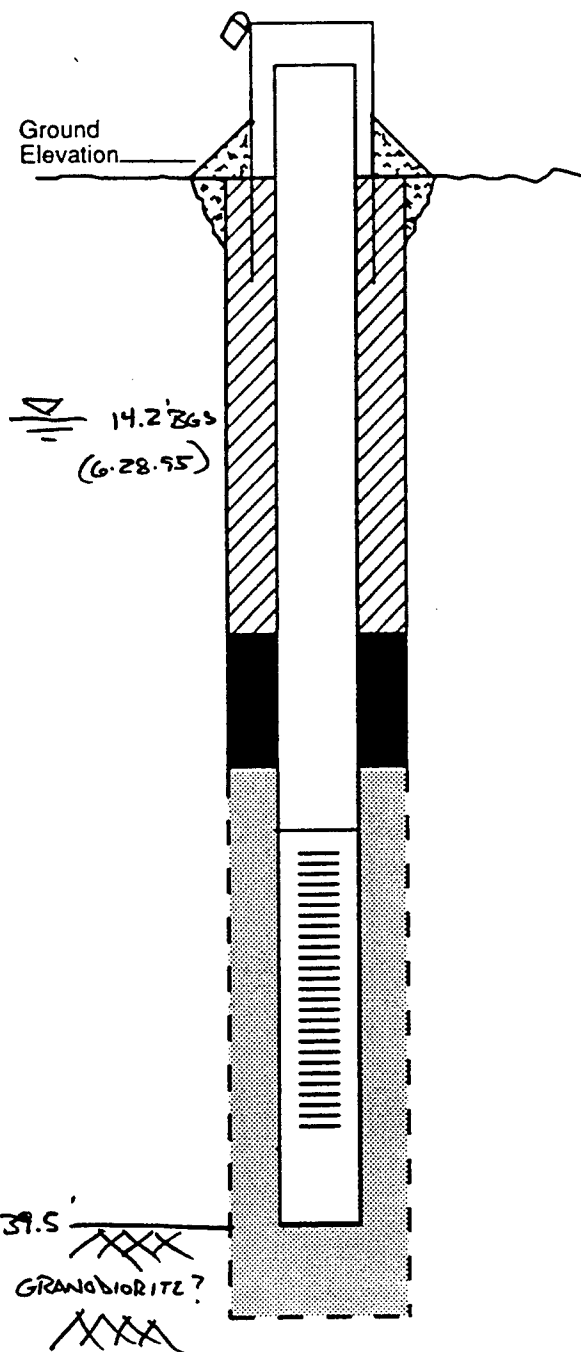
SOIL BORING LOG:

Client: USAEC				Project No. 08712-04		Study Area: SAL LANDFILL	
Contractor: D.L. MAHER		Date Started: 6.27.95		Boring No.: SUP. 95-27X		Protection: MGS D	
Method: D + WASH		Casing Size: 3" ID		Completed: 6.28.95		PI Meter: TE/0.5m	
Ground Elev.:		Soil Drilled: 39.5		Total Depth: 40.5			
Logged by: RRR		Checked by:		Below Ground: 14.2 (6.28.95)			
Screen: (ft.)	Riser: (ft.)	Diam: (ID)	Material:	Page 3 of 3			

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	WELL DATA
38		90				REFUSAL W/ CASING AT 39.5' BGS		
40		120±6"				CLEANING OUT HOLE W/ ROLLERBIT		
						AT 39.5' START TIEING UP		
						PHYLLITE CUTTINGS, WILL ADVANCE		
						ROLLERBIT.		
						ROLLERBIT ADVANCED TO 41.5'		
						GREY/BLACK ROCK CUTTINGS THAT		
						APPEAR TO BE GRANODIORITE		
						COMING UP THE HOLE.		
						LOSE WATER CIRCULATION AT 40'		
						WATER COMING UP OUTSIDE OF CASING.		
						XXX 39.5' BGS		
						GRANODIORITE?		
						<u>BOE = 40.5'</u>		
						6.27.95 COMPLETED DRILLING		
						AT 1710 HRS.		
						6.28.95. 0800 HRS.		
						SEDIMENTS SETTLED TO 38' BGS		
						IN CASING WILL RESET CASING		
						AND WASH OUT THE HOLE.		

MONITORING WELL CONSTRUCTION DIAGRAM

Project Fort Devens Study Area SHL - LANDFILL CONTAMINANT Driller J. GRAGLIA (D.L. MAHER)
 Project No. 08712-04 Boring No. SNP. 95-27X Drilling Method DRIVE & WASH 3" I.D.
 Date Installed 6-28-95 Development Method NA
 Field Geologist R. RUSTAD



Stick-up of Casing Above Ground Surface: _____
 Type of Surface Seal/ Other Protection: MORTAR COLLAR
 Type of Surface Casing: STEEL
 ID of Surface Casing: 4"
 Diameter of Borehole: 3"
 Riser Pipe ID: 1"
 Type of Riser Pipe: SCH 40 PVC
 Type of Backfill: 20:1 CEMENT/BENTONITE GROUT
 Depth of Top of Seal: 25'
 Type of Seal: BENTONITE SLURRY SEAL (TRIMED)
 Depth of Top of Sand: 25'
 Depth of Top of Screen: 30.5'
 Type of Screen: SCH 40 FACTORY SLOTTED PVC
 Slot Size x Length: 0.01" x 10'
 ID of Screen: 1"
 Type of Sandpack: FILTER SAND
 Depth of Bottom of Screen: 40.5'
 Depth of Sediment Sump with Plug: 40.5'
 Depth of Bottom of Borehole: 40.5' BGS

SOIL BORING LOG

Study Area: SHL - Low Fill Gravel

Boring No.: SHB 95-28Y

Client: USAEC

Project No. 08712-04

Protection: Mod D

Contractor: D.L. Maher

Date Started: 6-28-95

Completed: 6-29-95

Method: D/W

Casing Size: 3" Ø Flush Joint (IV)

PI Meter: TE/0VM

Ground Elev.: 27.2

Soil Drilled: 27.2

Total Depth: 32.7

Logged by: CPL

Checked by:

Below Ground: ~19' bgs after drilling

Screen: NA (ft.)

Riser: NA (ft.)

Diam: NA (ID)

Material: NA

Page 1 of 2

Note: Reference Samples were collected from all intervals

HS: Headspace

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS.	Casing Blows / FT	WELL DATA
2.5	S-1	0-20	N	1.3/20	0.0 (0.4) HS	SAND, well graded, coarse to fine, 15-25% gravel, <10% silt, non-plastic sand; subrounded to subangular, loose dry, 7.5R-3/4 no structure, possibly fill or reworked soil	SW	5 7 10	12
5.0	S-2	5-70	N	1.5/20	0.0 (0.4) HS	SAND, moderately graded, medium to fine trace gravel 10% coarse sand, 5-10% silt, non-plastic, sand; subangular to subrounded to rounded, moist, loose, 7.5R-2/3 very crude structure.	SP-SM	6 7	3 7
10.0	S-3	10-12	N	1.4/20	0.0 (0.4) HS	SAND, moderately to well graded, fine to medium, 10-15% coarse sand, 5-10% gravel 5-10% silt, non-plastic. sand is subangular (coarse) subrounded (med.-fine) loose moist to damp, 7.5R-3/2 slightly mottled w/crude structure, slightly coarser at top.	SW-SP	2 2	4 6
15.0	S-4	15-17	N	1.3/20	0.0 (0.4) HS	SAND, moderately to well graded, fine to medium 5-10% coarse sand, trace gravel, 10-15% silt, non-plastic, sand is subangular to subrounded, loose to semi-dense, damp, mottled with one 1/4" oxidized sand layer.	SW-SP	4 4 4	4 7
20.0	S-5	20-22	N	0.9/20	0.0 (0.4) HS	SAND, poorly graded, medium to mostly fine sand, 5% coarse sand, 10-15% medium sand 20-30% silt, non-plastic, sand is subrounded, semi-dense, saturated (dilatant) crudely stratified to no stratification (glacio-fluvial?)	SP-SM	5 5 4	3 7
22.5									8
25.0									9
									16

ROUTED TO SURFACE

SOIL BORING LOG

Client: USAEC				Project No. 08712-04		Study Area: SHL - Landfill Counsel.	
Contractor:				Date Started: 6-28-95		Boring No.: SHB-95-28K	
Method: D/W				Casing Size: 3" ϕ Flush Joint (NW)		Protection: Mod D	
Ground Elev.: 27.2				Soil Drilled: 27.2		Completed: 6-29-95	
Logged by: CPL				Checked by:		PI Meter: TE/0UM	
Screen: N/A (ft.)				Riser: N/A (ft.)		Total Depth: 32.7	
Diam: N/A (ID)				Material: N/A		Below Ground: 219' bgs (after drilling)	
Page 2				of: 2 (see Rock core)			

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	Casing Blows/ft	WELL DATA
25-27.2	56	25-27.2	N	12	0.0	SILT, 15-20% Fine sand 5-10% medium sand 5% coarse sand, 5-10% gravel, fines only slightly plastic. Sand is subangular to angular, semi-dense 7.5:2-4/2, no structure (glacial Till)	ML	7	
27.2	R-1	to		45	50	competent Bedrock @ 26.7, Rock core to 27.2. Start to core @ 27.2' bgs			
32.7		32.7				See Rock Core Sheet			
30						Bottom Boring = 32.7' Bbs			
32.5									
35									
37.5									
40									
42.5									
45									
47.5									
50									

ROCK CORING LOG

Project: Fort Devens		Study Area: SHL - Landfill Cons.		Project No. 8712-04	
Client: USAEC		Driller's Name: John Graglia		Logged by: CPL	Checked by:
Drilling Contractor: D. J. Maher		Protection Level: Mod D		Rig Type: Moh. 1353	Start Date: 6-29-95
Drilling Method: 3" Ø w/ (o.v.b.) NQ (Redrock)		P.I.D. (eV): TE / OVM		Casing Size: 3" Ø (NW)	Auger Size: NA
Bit type/size: NQ (DC3E)		Bit Use: Minimal		Core Interval (to/from) (ft): 27.2 - 32.7	

Depth (feet) Below G.P. Surf.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Core Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			Type/Dip	Surface Condition		Total 4" Core	RQD (%)	Rock Quality Description			
26.7											Incompetent Rock
27	27.2										Competent Rock w/ Roller cone
27.5		R-1	mech Break		None				2:53		Gray to greenish gray fine-grained meta sediment or meta-volcanic rock. Rock is very competent and all fractures are along previous healed fractures, and appear very flat. Fractures appear to be at angle to bedding or foliation and almost appear to be argillaceous. Rock is fairly siliceous and quartz appears to fill many of the healed fractures and forms the white stringers observed in the rock.
28											
28.5			Healed Fracture						3:30		
29			Fracture conjugate 120-60°		not weathered						
29.5			~45° dip						4:35		
30			D.K. Light				100%				
30.5			Stringers	weathered fracture	Slightly				5:05		
31											1.5' of core in bottom of boring (core would not break)
31.5			Recovery only			4.5'			5:10		
32			Bottom of core								
32.5						(4.5')					
33			Penetration			5.5'					B.O.B @ 32.7

35.35 TO
31.55 BGS

GEOTECHNICAL EVALUATION AT
CONSOLIDATION LANDFILL SITE

ABB Environmental Services, Inc.



TECHNICAL MEMORANDUM

PROJECT NO.: 8712-04

MEMO BY: Lyle Tracy, P.E.

DATE: 1/24/97

SUBJECT: Supplemental Preliminary Geotechnical Evaluation
Landfill Remediation Feasibility Study
Ft. Devens, MA

In August 1995, ABB-ES performed a preliminary geotechnical evaluation for the conceptual design of a new debris landfill at Fort Devens, MA. The conceptual landfill was planned as part of consolidation of debris from several areas of concern (AOCs) at the base. The results of that geotechnical evaluation were summarized in a technical memorandum dated August 24, 1995, and presented in Appendix F of the Draft Consolidation Landfill Feasibility Study (ABB-ES, 1995). The results of the 1995 evaluation were considered preliminary in nature, and additional evaluations were recommended during final design. This memorandum presents supplemental results of a geotechnical evaluation relevant to modifications to the landfill alternatives evaluated in 1995. The results of this evaluation should also be considered preliminary in nature; additional evaluations are recommended during final design.

PROJECT DESCRIPTION

The Consolidation Landfill has been proposed for the consolidation and disposal of construction debris from existing landfills at the base. Nine alternative plans have been evaluated as part of the Landfill Remediation Feasibility Study, and five alternatives propose to consolidate and dispose of debris from different AOCs. Variations of volumes, height, and sideslopes exist with each alternative. A detailed discussion of each alternative is presented in Section 8 of the Landfill Remediation Feasibility Study. Each alternative identifies the consolidation landfill site at a location east of Shepley's Hill Landfill (SHL), as shown in Figure 8-8. The landfill location evaluated would be a minimum of 50 feet east of the Phase II section of SHL, with minimum set backs of 100 feet from the reservation boundary to the east, and 250 feet from Plow Shop Pond to the north.

Subsurface conditions at the proposed landfill site were summarized in the August 24, 1995 Preliminary Geotechnical Evaluation technical memorandum.

EVALUATION AND CONCLUSIONS

General. In 1995, the preliminary geotechnical evaluation for the landfill alternatives focused on debris fill induced settlement, global stability, and cover geosynthetic/soil interface stability. From a geotechnical perspective, the critical scenario for each of these parameters typically occurs with a combination of the greatest fill height (largest load) and/or steepest waste slope (assuming constant subsurface conditions and existing grades). This critical scenario would occur for Alternative 9, where the debris fill height would be approximately elevation 290 feet (366,000 cubic yards of waste plus cover). Alternative 9 utilizes 3H:1V (horizontal to vertical) sideslopes, and a landfill cell bottom ranging from approximately elevation 224 feet to elevation 238 feet. The results of this reevaluation are presented in the following paragraphs.

Settlement. Settlement of the proposed landfill would occur from a combination of foundation soil settlement and waste/debris settlement, and magnitudes would be comparable to those estimated in 1995. A preliminary estimate of foundation soil settlement induced by waste loading from Alternative 9 ranges from approximately 2 to 5 inches, and settlement of the native sand would be complete within approximately 1 month of completion of filling.

As stated in the 1995 evaluation results, settlement of the waste fill can be minimized by controlled filling. In addition, detailed estimates can be evaluated during final design, and the anticipated settlement accounted for in the grading of the cover system, so that final grades can meet required minimums slopes (typically 3 to 5 percent at the top and 3H:1V on the sideslopes).

Slope Stability. During the 1995 evaluation, the landfill geometry with the highest fill loading and steepest sideslopes were evaluated. Static and seismic stability was evaluated. The minimum factors of safety (FS) against failure were as follows:

Static Conditions: $FS_{min} = 3.2$

Seismic Conditions: $FS_{min} = 1.8$

The minimum FS for each case consisted of a rotational failure.

The waste and soil geometry for Alternative 9 is comparable to that evaluated in 1995, except that the waste is approximately 6 feet deeper (landfill base is 6 feet deeper) for Alternative 9. Preliminary reevaluation of the stability of Alternative 9 indicated that the results were comparable to those presented in 1995, as the FSs, and critical failure circles did not change. The critical circles and resulting FSs are presented in the 1995 technical memorandum.

Minimum FSs for each case are site and project dependent, and would be established during final design. However, for comparison purposes, the following approximate guideline minimum FSs are provided:

Static Conditions $FS_{\min \text{ acceptable}} = 1.5$

Seismic Conditions $FS_{\min \text{ acceptable}} = 1.1$

The resulting FSs were significantly higher than typical minimum standards.

Geosynthetic/Soil Interface Stability.

The landfill cover buildup on the sideslopes is comparable to that evaluated in 1995, except that the 18-inches of clay has been eliminated. The profile consists of from the top downward:

- 6-inches topsoil
- 18-inches of moisture retention soil
- geotextile (filter)
- 12-inches of drainage sand
- textured geomembrane (LLDPE)
- 12-inches subgrade
- waste debris

The weakest interface would be between the geomembrane and the subgrade soil. The recommendations provided in 1995 are considered valid for this case (ie., requirement for textured geomembrane to resist sliding along the interface, and potential for the need to use veneer reinforcement depending upon the actual materials selected [soil and geosynthetic]). The potential for veneer reinforcement may be reduced by selecting a granular subgrade soil with low fines content. It is recommended that project specific laboratory shear testing be performed on proposed materials, and that literature interface results be used only for guidance.

**GEOTECHNICAL EVALUATION AT
CONSOLIDATION LANDFILL SITE**

ABB Environmental Services, Inc.



TECHNICAL MEMORANDUM

PROJECT NO.: 8712-04

MEMO BY: Lyle Tracy, P.E.

DATE: 1/24/97

SUBJECT: Supplemental Preliminary Geotechnical Evaluation
Landfill Remediation Feasibility Study
Ft. Devens, MA

In August 1995, ABB-ES performed a preliminary geotechnical evaluation for the conceptual design of a new debris landfill at Fort Devens, MA. The conceptual landfill was planned as part of consolidation of debris from several areas of concern (AOCs) at the base. The results of that geotechnical evaluation were summarized in a technical memorandum dated August 24, 1995, and presented in Appendix F of the Draft Consolidation Landfill Feasibility Study (ABB-ES, 1995). The results of the 1995 evaluation were considered preliminary in nature, and additional evaluations were recommended during final design. This memorandum presents supplemental results of a geotechnical evaluation relevant to modifications to the landfill alternatives evaluated in 1995. The results of this evaluation should also be considered preliminary in nature; additional evaluations are recommended during final design.

PROJECT DESCRIPTION

The Consolidation Landfill has been proposed for the consolidation and disposal of construction debris from existing landfills at the base. Nine alternative plans have been evaluated as part of the Landfill Remediation Feasibility Study, and five alternatives propose to consolidate and dispose of debris from different AOCs. Variations of volumes, height, and sideslopes exist with each alternative. A detailed discussion of each alternative is presented in Section 8 of the Landfill Remediation Feasibility Study. Each alternative identifies the consolidation landfill site at a location east of Shepley's Hill Landfill (SHL), as shown in Figure 8-8. The landfill location evaluated would be a minimum of 50 feet east of the Phase II section of SHL, with minimum set backs of 100 feet from the reservation boundary to the east, and 250 feet from Plow Shop Pond to the north.

Subsurface conditions at the proposed landfill site were summarized in the August 24, 1995 Preliminary Geotechnical Evaluation technical memorandum.

EVALUATION AND CONCLUSIONS

General. In 1995, the preliminary geotechnical evaluation for the landfill alternatives focused on debris fill induced settlement, global stability, and cover geosynthetic/soil interface stability. From a geotechnical perspective, the critical scenario for each of these parameters typically occurs with a combination of the greatest fill height (largest load) and/or steepest waste slope (assuming constant subsurface conditions and existing grades). This critical scenario would occur for Alternative 9, where the debris fill height would be approximately elevation 290 feet (366,000 cubic yards of waste plus cover). Alternative 9 utilizes 3H:1V (horizontal to vertical) sideslopes, and a landfill cell bottom ranging from approximately elevation 224 feet to elevation 238 feet. The results of this reevaluation are presented in the following paragraphs.

Settlement. Settlement of the proposed landfill would occur from a combination of foundation soil settlement and waste/debris settlement, and magnitudes would be comparable to those estimated in 1995. A preliminary estimate of foundation soil settlement induced by waste loading from Alternative 9 ranges from approximately 2 to 5 inches, and settlement of the native sand would be complete within approximately 1 month of completion of filling.

As stated in the 1995 evaluation results, settlement of the waste fill can be minimized by controlled filling. In addition, detailed estimates can be evaluated during final design, and the anticipated settlement accounted for in the grading of the cover system, so that final grades can meet required minimums slopes (typically 3 to 5 percent at the top and 3H:1V on the sideslopes).

Slope Stability. During the 1995 evaluation, the landfill geometry with the highest fill loading and steepest sideslopes were evaluated. Static and seismic stability was evaluated. The minimum factors of safety (FS) against failure were as follows:

Static Conditions: $FS_{min} = 3.2$

Seismic Conditions: $FS_{min} = 1.8$

The minimum FS for each case consisted of a rotational failure.

The waste and soil geometry for Alternative 9 is comparable to that evaluated in 1995, except that the waste is approximately 6 feet deeper (landfill base is 6 feet deeper) for Alternative 9. Preliminary reevaluation of the stability of Alternative 9 indicated that the results were comparable to those presented in 1995, as the FSs, and critical failure circles did not change. The critical circles and resulting FSs are presented in the 1995 technical memorandum.

Minimum FSs for each case are site and project dependent, and would be established during final design. However, for comparison purposes, the following approximate guideline minimum FSs are provided:

Static Conditions $FS_{\text{min acceptable}} = 1.5$

Seismic Conditions $FS_{\text{min acceptable}} = 1.1$

The resulting FSs were significantly higher than typical minimum standards.

Geosynthetic/Soil Interface Stability.

The landfill cover buildup on the sideslopes is comparable to that evaluated in 1995, except that the 18-inches of clay has been eliminated. The profile consists of from the top downward:

- 6-inches topsoil
- 18-inches of moisture retention soil
- geotextile (filter)
- 12-inches of drainage sand
- textured geomembrane (LLDPE)
- 12-inches subgrade
- waste debris

The weakest interface would be between the geomembrane and the subgrade soil. The recommendations provided in 1995 are considered valid for this case (ie., requirement for textured geomembrane to resist sliding along the interface, and potential for the need to use veneer reinforcement depending upon the actual materials selected [soil and geosynthetic]). The potential for veneer reinforcement may be reduced by selecting a granular subgrade soil with low fines content. It is recommended that project specific laboratory shear testing be performed on proposed materials, and that literature interface results be used only for guidance.



TECHNICAL MEMORANDUM

PROJECT NO: 8712-04

FROM: Kim LaMarre, P.E.

DATE: August 24, 1995

SUBJECT: Preliminary Geotechnical Evaluations
Consolidation Landfill Feasibility Study
Ft. Devens, MA

This memorandum presents the results of the geotechnical investigations and preliminary geotechnical evaluations relative to the construction of a new debris landfill to be located at Fort Devens, Ma. These evaluations are for conceptual design purposes only; additional evaluations may be warranted during final design.

PROJECT DESCRIPTION

A Consolidation Landfill has been proposed to dispose of soil and construction debris obtained from removal actions performed at 7 other areas of concern located at Fort Devens. The debris would primarily include wood, concrete, and other building materials. The new landfill would be located just east of the existing Shepley's Hill Landfill (Figure-1).

The Shepley's Hill Landfill site is located on the Main Post in the Town of Ayer. The site is approximately 12 acres in size and is bounded on the north by Plow Shop Pond, on the west and south by Shepley's Landfill, and on the east by the Army reservation boundary.

Two grading plans, Alternative D and Alternative E, have been developed for the conceptual design of the Shepley's Hill Site. Alternative D assumes that all excavated soil debris will be disposed in the landfill (255,000 cubic yards [cy] total capacity). Alternative E assumes that portions of the debris will be reclaimed (84,000 cy total

capacity). Alternative D proposes grades of 3 horizontal (H) to 1 vertical (V) from elevation (el) 235 to el 290 feet and would encompass approximately 6 acres. Alternative E proposes grades of 5H:1V from approximately el 235 to el 266 feet and would encompass approximately 7 acres.

SUBSURFACE CONDITIONS

As part of the conceptual evaluation for constructing a landfill at the Shepley's Hill site, three borings were drilled within the footprint of the proposed landfill to supplement existing geologic information. The locations of the borings are shown on Figure 1 attached. Two of the borings, SHP-95-27 and SHB-95-28 were drilled using 3-inch inside diameter (ID) flush joint casing; the remaining boring, SHB-95-26 was drilled using 4 1/4 inch ID hollow stem augers. SHP-95-27 and SHB-95-28 were drilled to 50 feet or refusal, whichever was shallower; SHB-95-28 was drilled to the bedrock surface and 5 feet of rock core was obtained. Logs of the borings are appended to this memo.

Subsurface conditions at the proposed site generally consisted of loose to medium dense, fine to medium sand with varying amounts of silt (trace to silty). Only isolated layers contained the higher fraction of silt; the deposit typically has a trace amount of silt. The findings of these explorations were generally consistent with the existing geologic information obtained to the east of the proposed site. Grain size analyses were performed on 6 samples selected from the borings; the gradation curves are attached to this memo.

Bedrock was identified in SHP-95-27 and SHB-95-28 at approximately 40 and 27 feet below ground surface (bgs), respectively. The bedrock cored in SHB-95-28 was identified as a phyllite and was found to be of excellent quality. The bedrock which comprises Shepley's Hill is granodiorite. The actual contact between the phyllite and the granodiorite is believed to occur somewhere beneath the site of the Consolidation Landfill.

A 1-inch ID PVC piezometer was installed in SHP-95-27 to measure the depth to overburden groundwater. Groundwater was measured at approximately 14 feet bgs. Groundwater elevations have been measured in other wells to the east at approximately el 218 feet, roughly 16 to 18 feet below ground surface.

PRELIMINARY GEOTECHNICAL EVALUATIONS

The preliminary geotechnical evaluations focused on three areas:

- Settlement
- Slope stability
- Geosynthetic/soil interface stability

SETTLEMENT

Settlement of the landfill could occur as a result of consolidation of the foundation soils or consolidation of the waste soil and debris. Excessive settlement can hinder the long-term performance of the liner and/or cover system because it causes these materials to strain under variable loading conditions.

Approximations of settlement were computed based on the steepest and highest grading plan of the three proposed landfill configurations (Alternative D). Foundation soils consisted of loose to medium dense, fine to medium sand. Settlement of the sand due to the landfill loading is expected to range from 2 to 3 inches. Settlement of sand typically occurs immediately; i.e., during filling. Therefore, no long-term settlement of foundation soils is expected once filling and capping is complete.

Consolidation of waste typically occurs in two phases; primary (immediate) settlement and secondary (biodegradation) settlement. Primary settlement usually occurs within the first 3 to 4 months of fully loading the debris and is the result of crushing or consolidating the waste. It is expected that waste will be placed in the landfill in a controlled manner; i.e., tracked with a dozer and covered with soil on a daily basis. This process should minimize primary settlement.

Secondary settlement results from exposure to air and infiltration of water. Waste will be allowed to biodegrade during filling to some extent. Once the final cover is in place, the potential for biodegradation will be significantly reduced due to the low permeability cover.

Based on the characteristics of the foundation soils, the controlled approach to waste placement, and the proposed final grades, settlement is not expected to adversely impact the performance of the landfill.

SLOPE STABILITY

Bearing capacity of the foundation soils was evaluated by performing a slope stability analysis. Alternative C was conservatively selected for evaluation. The stability was evaluated using the computer program SLOPE/W. Both static and pseudostatic (seismic) analyses were performed. The following soil parameters were used in the stability evaluations:

$$\begin{aligned}\gamma_{\text{waste}} &= 75 \text{ pounds/cubic foot (pcf)} \\ \gamma_{\text{sand}} &= 110 \text{ pcf} \\ \phi_{\text{waste}} &= 16 \text{ degrees} \\ \phi_{\text{sand}} &= 30 \text{ degrees} \\ c_{\text{waste}} &= 800 \text{ pounds/square foot}\end{aligned}$$

For the seismic evaluation, a peak horizontal acceleration of 0.34 was selected based on a 90 percent probability of not being exceeded in 250 years (USGS, Map MF-2120). One-half this peak acceleration was used to compute the seismic load in the analysis. Critical failure circles were evaluated in both the foundation soils and the waste. The minimum static factor of safety (FS) was 3.2. This failure circle was primarily confined to the waste. The minimum pseudostatic FS was 1.8. Figures 2 and 3 represent the critical failure circles for each case.

A pseudostatic analysis is a relatively conservative approach to evaluating stability during a seismic event. Additional methods of evaluation include a deformation analysis and a liquefaction analysis. A deformation analysis is often associated with soft (clay) foundation soils; liquefaction analyses are associated with loose sand foundation soils. Soils most susceptible to liquefaction are generally loose, saturated fine sands with a relatively low fines (silt and clay) content. The physical characteristics of the foundation soils at the landfill site are consistent with liquefiable soils; however groundwater across the site varies seasonally which impacts how much and how frequently the sand is saturated. Based on the above findings, it is recommended that the potential for liquefaction be evaluated in more detail during final design.

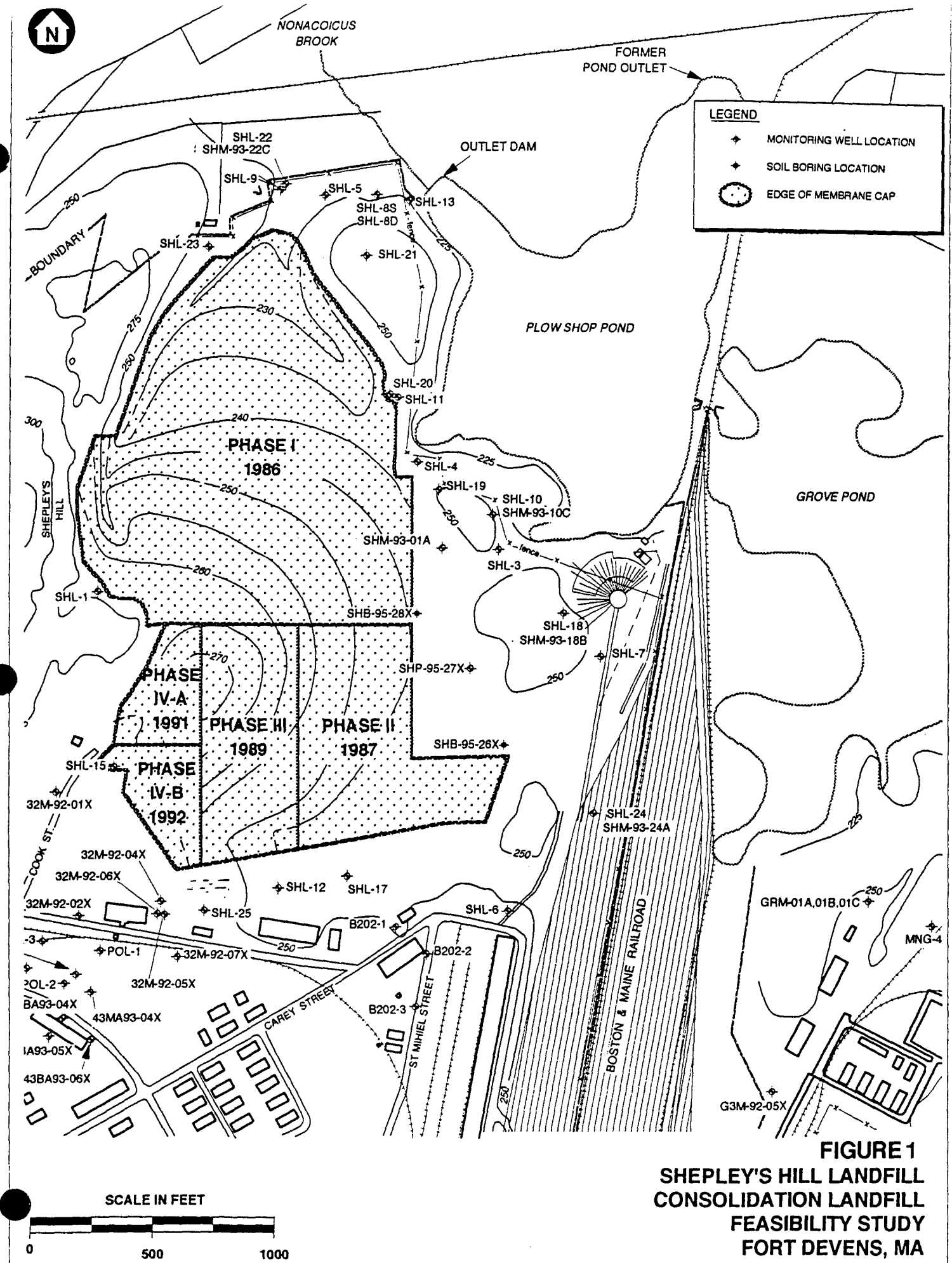
GEOSYNTHETIC/SOIL INTERFACE STABILITY

The proposed liner and cover materials were reviewed for stability against sliding based on the grading of Alternative D. Figure 4 attached depicts the proposed landfill liner and cover build-ups. Based on the proposed slopes and interface friction values obtained from published technical literature and manufacturer's data, the weakest interface would be between the geomembrane and the clay cover materials. It is anticipated that textured geomembrane would be required to resist sliding along the 3H:1V sideslopes. Depending upon the actual soil and geosynthetic materials selected during final design, it may also be necessary to provide a reinforcing geosynthetic or to flatten the proposed slopes in order to maintain veneer stability.

CONCLUSIONS

Based on the results of the preliminary evaluations, the foundation soils are expected to provide adequate support for the proposed loading. Both global stability and geosynthetic/soil geosynthetic/geosynthetic interface stability should be reassessed once final grades and materials are selected during the final design process.

enclosures



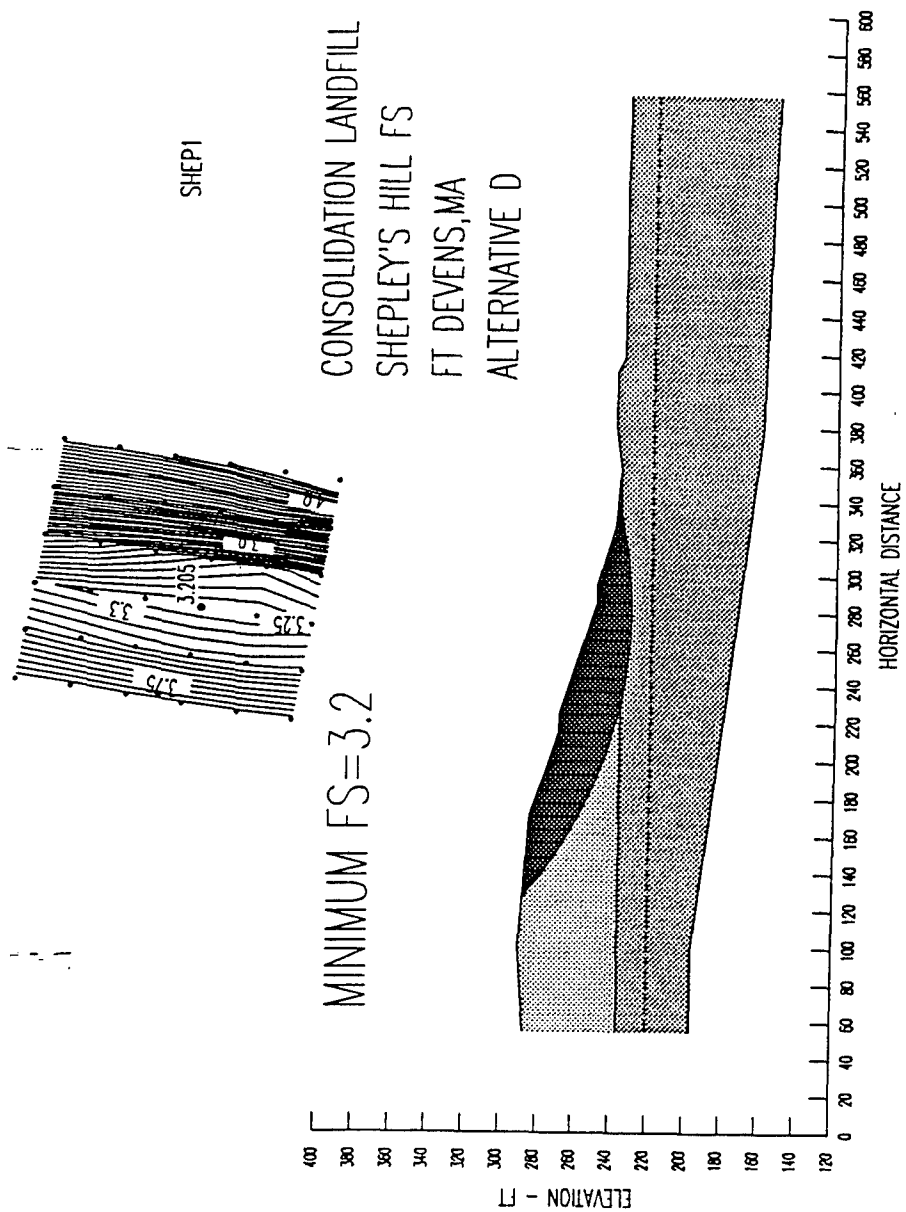
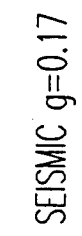


FIGURE 2
Static Stability
Analysis



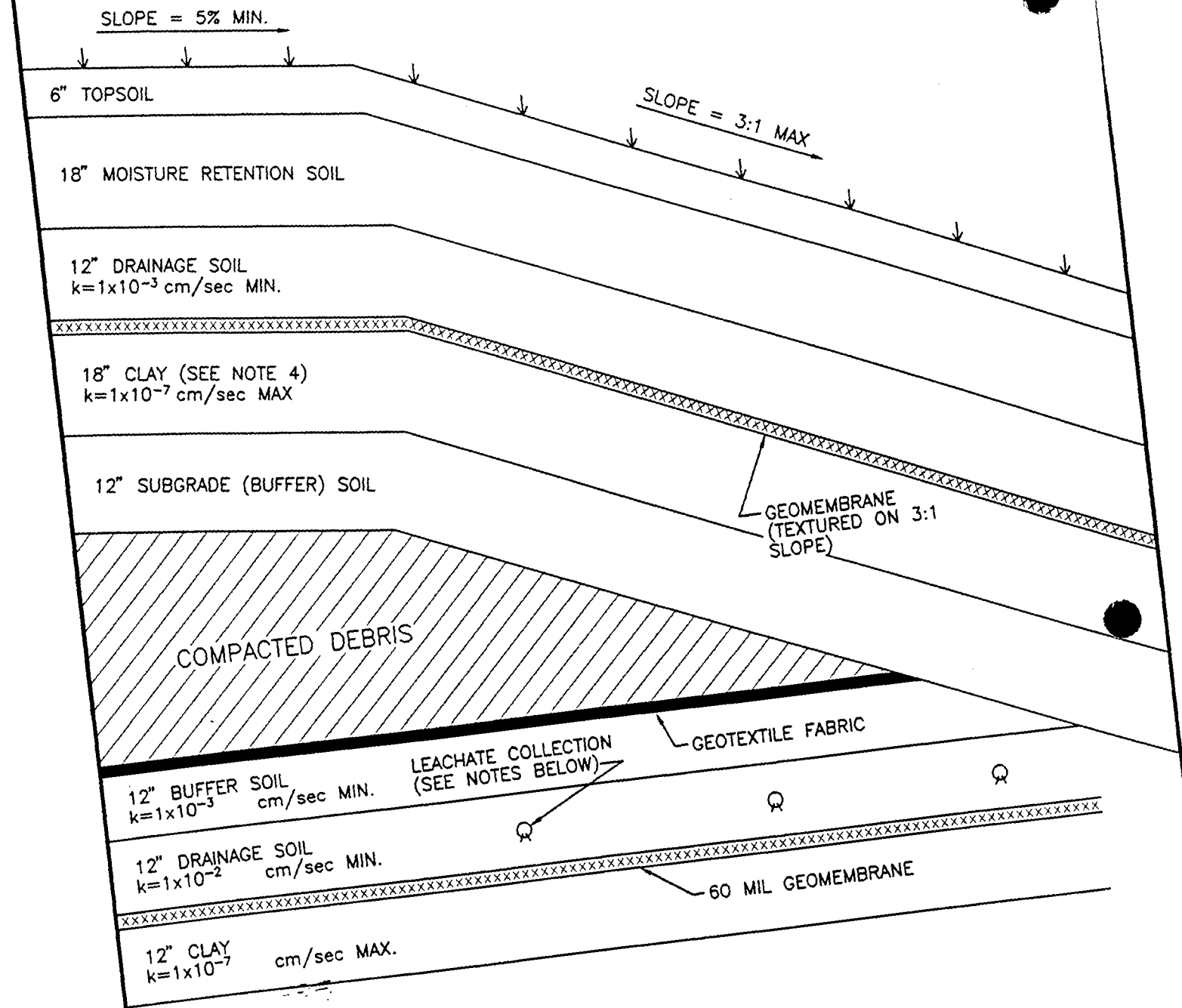
CONSOLIDATION LANDFILL
SHEPLEY'S HILL FS
FT DEVENS, MA
ALTERNATIVE D

MINIMUM FS=1.8

FIGURE 3
PSEUDOSTATIC
STABILITY ANALYSIS

LEGEND

↓ GRASS
 ○ PERFORATED PIPE



NOTES:

1. TOP OF CLAY (LINER) TO BE SLOPED @ 2% MIN.
2. LEACHATE TRUNK PIPES TO BE SLOPED @ 1% MIN. (6-INCH DIA.).
3. LEACHATE LATERAL PIPES TO BE SLOPED @ 1/2% MIN.
4. A GEOSYNTHETIC CLAY LINER MAY BE SUBSTITUTED FOR THE CLAY LAYER.

0 15 30 60 FEET
 SCALE: 1"=30'

FIGURE 4
 CROSS SECTION THROUGH CONSOLIDATION LANDFILL
 CONSOLIDATION LANDFILL FEASIBILITY STUDY
 FORT DEVENS, MA
 ABB Environmental Services, Inc.

BORING LOGS

SOIL BORING LOG

Client: USACE		Project No. 08712-04		Study Area: S4L - LANDFILL CONC.	
Contractor: D.L. MAHER		Date Started: 6.26.95		Boring No.: SHB-95-262	
Method: HSA		Casing Size: 4 1/4" I.D.		Protection: MODIFIED	
Ground Elev.: 		Soil Drilled: 49' (SAMPLED TO 51')		Completed: 6.27.95	
Logged by: RRR		Checked by: 		PI Meter: TE/ORM	
Screen: N/A (ft.)		Riser: N/A (ft.)		Total Depth: 51'	
Diam: N/A (ID)		Material: N/A		Below Ground: 13.3 (6.27.95)	
Page 1 of 3					

NOTE: REFERENCE SAMPLE COLLECTED FROM EVERY SPOON UNLESS NOTED.

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	2" O.D. SBOR 140# HAMMER BLOW COUNTS	WELL DATA
2	S-1	0-2	1.5 2.0	0.0		0-0.7 SAND, WELL GRADED, COARSE TO FINE, 5% GRAVEL, <5% SILT SUBROUNDED TO ROUNDED, LOOSE DRY, REDDISH TAN (SW)	(SW)	2 4 5 13	START 1300 6.26.95
4		2-4	1.5 2.0	0.0		0.7-1.5 SAND, POORLY GRADED, FINE, 15% MEDIUM, <5% SILT LOOSE, DRY, LIGHT YELLOW TAN. (SP)	(SP)	5 5 5 6	
6	S-2	4-6	1.5 2.0	0.0		SAND, POORLY GRADED, MEDIUM 10-15% FINE, SUBROUNDED TO SUBANGULAR, <5% FINES, LOOSE, DRY GRAYISH TAN. SILTY FINE SAND LAYER FROM 4.7-4.75' BGS THIN LAMINAE BEDDING VISIBLE THROUGHOUT SPOON (SP)	(SP)	10 10 12 10	1325
8		6-8	1.4 2.0	0.0		SILTY SAND, POORLY GRADED, FINE, 10-20% SILT, WET, MEDIUM DENSE LIGHT BROWN. 0.01" THICK SILT LENS AT 10' BGS. SLIGHTLY COARSER SAND IMMEDIATELY ABOVE THE SILT LENS (SP)	(SP)	WET 1340	
10	S-3	8-10	1.6 2.0	0.0		SAND, POORLY GRADED, FINE, 5% COARSE, 5-10% SILT, WET, VERY LOOSE, & LIGHT BROWN (SP)	(SP)	WET 1355	
12		10-12	1.8 2.0	0.0		AFTER AUGERING TO 20' BGS SAND HEAVES TO 18' BGS WILL HAVE TO ADD WATER TO SUPPRESS HEAVES (SP)	(SP)	2 2 2 6	13.3 BGS 6.27.95
14	S-4	12-14	1.8 2.0	0.0		SAND, POORLY GRADED, FINE, <5% FINES, 5% COARSE MEDIUM, WET VERY LOOSE. (RD) LIGHT BROWN TO TAN. "SPECKS" OF IRON STAINING VISIBLE THROUGHOUT SAMPLE (SP)	(SP)		1420

WOR = WEIGHT OF RODS

SOIL BORING LOG

Client: USAEC		Project No. 08712-04		Study Area: SHL - LANDFILL CONS.	
Contractor: D.L. MAHER		Date Started: 6.26.95		Boring No.: SHB-95-24X	
Method: HSA		Casing Size: 4 1/4" I.D.		Protection: MODIFIED D	
Ground Elev.: 122.2		Soil Drilled: 49' BGS (SAMPLED TO 51')		Completed: 6.27.95	
Logged by: TERTZ		Checked by:		PI Meter: TE-07M	
Screen: — (ft.)		Riser: — (ft.)		Total Depth: 51'	
Diam: — (ID)		Material: —		Below Ground: 13.3 6.27.95	
Page 2 of: 3					

REFERENCE SAMPLE COLLECTED FROM ALL SPOONS
UNLESS OTHERWISE NOTED 2" O.D. SPOON

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	BLOW COUNTS	WELL DATA
						SEE PREVIOUS PAGE			
22	S-5 COAL	14 21							
24	S-6	24 1 26		1.6 2.0	0.0	ADDING WATER TO AUGER NO HEAVE SANDS, POORLY GRADED, FINE, <5% FINES, <5% MEDIUM, WET, VERY LOOSE TO LOOSE, LIGHT BROWN	(SP)	3 6 4 3	1455
26									
28									
30	S-7	29 1 31		1.5 2.0	0.0	29-29.5 - SAND SIMILAR TO S-6 29.5-30.5 - KNIFE EDGE CONTACT SAND, POORLY GRADED, FINE, 5-10% MEDIUM, <5% FINES, WET, LOOSE GREY, ANGULAR TO SUBANGULAR,	(SP)	2 4 4 8	1515
32									
34	S-8	34 1 36		1.8 2.0	0.0	0-1.1: SANDS, POORLY GRADED, SIMILAR TO 29.5-30.5 SAMPLE BUT WITH SEVERAL 0.05" THICK BROWN SAND (FINE) LENSES. 4.5-35.1' BGS - SILT LENS, BLuish GREY, SLIGHTLY PLASTIC 35.1-35.8 - SAND, POORLY GRADED, FINE, GREY SIMILAR TO ABOVE (34-35.1)	(SP) (ML) (SP)	8 9 6 3	1535
36									
38									
40	S-9	39 1 41		1.3 2.0	0.0	39-39.3 - SAND, POORLY GRADED, FINE GREY SIMILAR TO ABOVE. LOOSE-V. LOOSE	(SP)	2 4 10 10	1555

SOIL BORING LOG

Client: USAEC		Project No. 08712.04		Study Area: SHL - LANDFILL CONS.	
Contractor: D.L. MAHER		Date Started: 6.26.95		Boring No.: SHB. 95. 26X	
Method: HSA		Casing Size: 4 1/4" I.D.		Protection: MODIFIED D	
Ground Elev.: 		Soil Drilled: 49' BGS (SAMPLED TO 51')		Completed: 6.27.95	
Logged by: RRR		Checked by: 		PI Meter: TE/ORM	
Screen: — (ft.)		Riser: — (ft.)		Total Depth: 51'	
		Diam: — (ID)		Below Ground: 13.3	
		Material: —		Page 3 of: 3	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	WELL DATA
42	S.9 CONT	41	1.3 2.0	0.0	0.0	39.3 - 39.5 - SANDS, POORLY GRADED, MEDIUM, 10-15% FINE, <5% FINES, WET, LOOSE, REDDISH TAN, SUBANGULAR TO SUBROUND.	SP	
44	S.10	44 46	0.9 2.0	0.0	0.0	39.5 - 40.3 - SANDS, POORLY GRADED, MEDIUM, 20% FINE, <5% FINES, WET, LOOSE, GREY, SUBANGULAR.	SP	
46								1615
48						STILL ADDING WATER TO AUGERS TO SUPPRESS PRESSURE HEAD		
50	S.11	49 51	1.2 2.0	0.0	0.0	SAND, POORLY GRADED, FINE, <5% FINES, WET, LOOSE TO MEDIUM DENSE, GREYISH GREEN	SP	1635
52						B.O.E = 51' BGS (SPOON) 49' BGS (AUGER) 1645 COMPLETED 6.26.95 0800 6.27.95 BEGIN PULLING AUGERS AND GROUTING. SL = 13.3' 1000 - GROUTING COMPLETE 13 BAGS CEMENT 1 BAG BENTONITE POWDER TRM-2 PLACED		

SOIL BORING LOG

Study Area: SHL- LANDFILL CONSOLIDATION

Client: USAEC	Project No. 08712.04	Boring No.: SHP.95.27X
Contractor: D.L. MAHER	Date Started: 6.27.95	Protection: MODIFIED
Method: DRIVE + WASH	Casing Size: 3" I.D. CASING	Completed: 6.28.95
Ground Elev.:	Soil Drilled: 39.5	PI Meter: TE-07M
Logged by: KRR	Checked by:	Total Depth: 14.5
Screen: (ft.)	Riser: (ft.)	Below Ground: 14.2' (6.28.95)
Diam: (ID)	Material:	Page 1 of: 3

REFERENCE SAMPLE COLLECTED FROM EVERY SPOON.

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH 3" CASING 100 15/16" CASING 100 15/16" CASING Blows	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	2" SPOON 140 lb HAMMER BLOW COUNTS	WELL DATA SEE WELL CONST. DING.
2	S-1	3	1.3	0.0	SAND POORLY GRADED, FINE, 10-20% MEDIUM, < 5% SILT DRY, LOOSE SUBROUNDED, YELLOW TAN LAMINAR BENDING THROUGHOUT	SP	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1215
4		7	2.0					
6	S-2	2	0.9	0.0	SAND, POORLY GRADED, FINE, 5% MEDIUM, 25% FINES, MOIST (DUE SOLELY TO WASHING) LOOSE, VERY LIGHT TAN, SUBANGULAR	SP	3 6 7 9 10 11 12 13 14 15 16 17 18 19 20	1315
8		7	2.0					
10	S-3	1	0.9	0.0	10-10.6 - SAND SIMILAR TO S-2	SP	6 7 9 10 11 12 13 14 15 16 17 18 19 20	1340
12		7	2.0		10.6-10.8 - SAND, POORLY GRADED, FINE, 10-15% SILT, MOIST, LOOSE, BROWN	SP		
14		15			10.8-10.9 - SAND, POORLY GRADED, FINE, < 5% FINES, DRY, LOOSE, LIGHT GREY TAN, SUBROUNDED	SP		
16	S-4	1	1.4	0.0	15-15.2 - SAND, POORLY GRADED, FINE 10-15% MEDIUM, < 5% FINES, WET, LOOSE LIGHT BROWN, SUBROUNDED TO SUBANGULAR	SP	5 6 7 9 10 11 12 13 14 15 16 17 18 19 20	1405
18		9	2.0		15.2-15.7 - SAND, FINE, 5-10% SILT LOOSE, WET, SUBROUNDED, MEDIUM BROWN	SP, SM		
20		10			15.7-16.4 - SAND TO SILTY SAND, POORLY GRADED, FINE, 5-15% SILT, LOOSE WET, GREY, SUBANGULAR, MICACEOUS.	SP, SM		

SOIL BORING LOG

Client: <u>USAEC</u>				Project No. <u>08712.04</u>		Study Area: <u>SHL-LANDFILL CONS.</u>	
Contractor: <u>D.L. MAUR</u>		Date Started: <u>6.27.95</u>		Boring No.: <u>SHP.95.27X</u>		Protection: <u>MOD D</u>	
Method: <u>D+W</u>		Casing Size: <u>3" ID</u>		Completed: <u>6.28.95</u>		PI Meter: <u>TE/GUN</u>	
Ground Elev.: <u></u>		Soil Drilled: <u>39.5</u>		Total Depth: <u>40.5</u>		Below Ground: <u>14.2 (6.28.95)</u>	
Logged by: <u>RRR</u>		Checked by: <u></u>		Screen: (ft.)		Riser: (ft.)	
Diam: (ID)		Material:		Page 2 of 3			

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	CASING BLOW COUNTS	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	2" SPOON BLOW COUNTS	WELL DATA
20		20	10	1.2	0.0	SAND, POORLY GRADED, FINE, 5-10% SILT, WET, LOOSE, MEDIUM BROWN, SUBANGULAR. (DISTINCTLY DIFFERENT IN COLOR FROM GREY SAND AT 16')	(SP)	5 5 6 7	14.50
22	5.5	22	12	2.0					
24			13						
26		25	15	1.2	0.0	SAND, POORLY GRADED, FINE, 5%-10% MEDIUM, < 5% SILT, WET, LOOSE, LT BROWN, GRADING TO GREY, SUBROUNDED	(SP)	4 6 5 6	14.50
28	5.6	27	22	2.0					
30		24							
32		27							
34		28							
36	5.7	30	30	1.2	0.0	SAND, POORLY GRADED, FINE, < 5% SILT, WET, LOOSE, GREY	(SP)	8 4 4 7 5 4 5	
38		32	39	2.0		30.7 - 30.9 - SAND, POORLY GRADED, FINE (BUT COARSER THAN ABOVE) < 5% SILT, WET, LOOSE, RED RED FeO ₂ STAINING. (RD)	(SP)		
40		34	44			30.9 - 30.2 - SAND, POORLY GRADED FINE, 5-10% SILT, LOOSE, WET, GREY	(SP/SM)		
42		35	51	1.5	0.0	SAND, POORLY GRADED SIMILAR TO 30.9 TO 31.2 FT BGS	(SP)	8 8 5 4	
44	5.8	37	54	2.0		GRADING TO SALTY SANDS, FINE, 20% SILT, LOOSE, WET, GREY	(SM)		
46			78						

SOIL BORING LOG

Client: USAEC				Project No. 08712-04		Study Area: SHL LANDFILL CONT.	
Contractor: D.L. MAHER		Date Started: 6.27.95		Boring No.: SHP.95.27X		Protection: MOD D	
Method: D + WS 3U		Casing Size: 3" ID		Completed: 6.28.95		PI Meter: TE/ORM	
Ground Elev.:		Soil Drilled: 39.5		Total Depth: 40.5		Below Ground: 14.2 (6.28.95)	
Logged by: RRR		Checked by:		Page 3 of 3			
Screen: (ft.)	Riser: (ft.)	Diam: (ID)	Material:				

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	WELL DATA
38			90			REFUSAL W/ CASING AT 39.5' BGS		
40			120-6"			CLEANING OUT HOLE W/ ROLLERBIT		
						AT 39.5' START BRINGING UP		
						PHYLLITE CUTTINGS, WILL ADVANCE		
						ROLLERBIT.		
						ROLLERBIT ADVANCED TO 41.5'		
						GREY/BLACK ROCK CUTTINGS THAT		
						APPEAR TO BE GRANODIORITE		
						COMING UP THE HOLE.		
						LOSE WATER CIRCULATION AT 40'		
						WATER COMING UP OUTSIDE OF CASING.		
						XXX 39.5' BGS		
						GRANODIORITE?		
						<u>BOE = 40.5'</u>		
						6.27.95 COMPLETED DRILLING		
						AT 1710 HRS.		
						6.28.95. 0800 HRS.		
						SEDIMENTS SETTLED TO 38' BGS		
						IN CASING WILL RESET CASING		
						AND WASH OUT THE HOLE.		

Project Fort Devens

Study Area SHL - LANDFILL CONT. Driller J. GRAGLIA (D.L. MAHER)

Project No. 08712-04

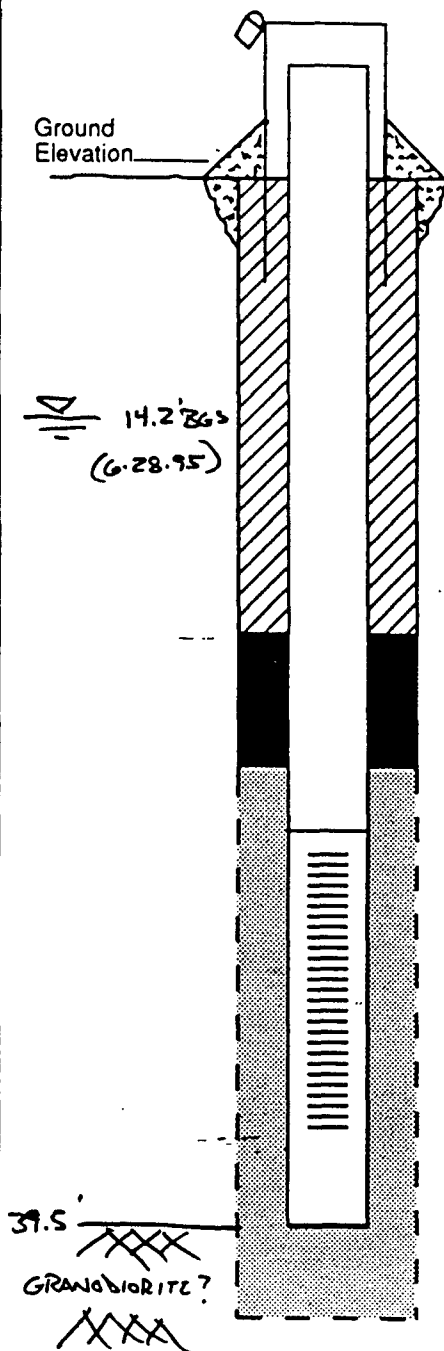
Boring No. SNP-95-27X

Drilling Method DRIVE & WASH 3" ID.

Date Installed 6-28-95

Development Method NA

Field Geologist R. RUSTAN



Stick-up of Casing Above Ground Surface: _____

Type of Surface Seal/ Other Protection: MORTAR COLLAR

Type of Surface Casing: STEEL

ID of Surface Casing: 4"

Diameter of Borehole: 3"

Riser Pipe ID: 1"

Type of Riser Pipe: SCH 40 PVC

Type of Backfill: 20:1 CEMENT/BENTONITE GROUT

Depth of Top of Seal: 20'

Type of Seal: BENTONITE SLURRY SEAL (PREMIXED)

Depth of Top of Sand: 25'

Depth of Top of Screen: 30.5'

Type of Screen: SCH 40 FACTORY SLOTTED PVC

Slot Size x Length: 0.01" x 10'

ID of Screen: 1"

Type of Sandpack: FILTER SAND

Depth of Bottom of Screen: 40.5'

Depth of Sediment Sump with Plug: 40.5'

Depth of Bottom of Borehole: 40.5' RGS

SOIL BORING LOG

Client: USAEC		Project No. 08712-04		Study Area: SHL - Landfill/Consol	
Contractor: D.L. Maher		Date Started: 6-28-95		Boring No.: SHB 95-28x	
Method: D/W		Casing Size: 3" Ø Flush Joint (N)		Protection: Mod D	
Ground Elev.:		Soil Drilled: 27.2		Completed: 6-29-95	
Logged by: CPL		Checked by:		PI Meter: TE/OVM	
Screen: NA (ft.)		Riser: NA (ft.)		Total Depth: 32.7	
Diam: NA (ID)		Material: NA		Below Ground: ~19' bgs after drill	
Page 1		of 2			

Note: Reference Sample were collected from all intervals

HS: Headspace

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	Casing Blows / FT	WELL DATA
2.5	S-1	0-20	N	1.3/20	0.0 (0.0) (HS)	SAND, well graded, coarse to fine, 15-25% gravel, <10% silt, non-plastic sand; subrounded to subangular, loose dry, 7.5R-3/4 no structure, possibly fill or reworked soil	SW	5 7 10	12 16 4 10 6
5.0	S-2	5.0-7.0	N	1.5/20	0.0 (0.4) (HS)	SAND, moderately graded, medium to fine trace gravel 10% coarse sand, 5-10% silt, non-plastic, sand; subangular to subrounded to rounded, moist, loose, 7.5R-2/3 very crude structure.	SP-SM	8 6 6 7	3 7 7 12 10
10.0	S-3	10-12	N	1.4/20	0.0 (0.0) (HS)	SAND, moderately to well graded, fine to medium, 10-15% coarse sand, 5-10% gravel 5-10% silt, non-plastic. sand is subangular (coarse) subrounded (med-fine) loose, moist to damp, 7.5R-3/2, slightly mottled w/ crude structure, slightly coarser at top.	SW-SP	2 1 2 2	4 6 7 9 11
15.0	S-4	15-17	N	1.3/20	0.0 (0.0) (HS)	SAND, moderately to well graded, fine to medium 5-10% coarse sand, trace gravel, 10-15% silt, non-plastic, sand is subangular to subrounded, loose to semi-dense, damp, mottled with one 1/4" oxidized sand layer.	SW-SP	4 4 4 4	4 7 9 12 14
20.0	S-5	20-22	N	0.6/20	0.0 (0.4) (HS)	SAND, poorly graded, medium to mostly fine sand, 5% coarse sand, 10-15% medium sand 20-30% silt, non-plastic, sand is subrounded, semi-dense, saturated (dilatant) 7.5R-4/2 crudely stratified to no stratification (glacio-fluvial?)	SP-SM	5 5 5 4	3 7 8 9 16

GROUTED TO SURFACE

SOIL BORING LOG

Client: USAEC				Project No. 08712-04		Study Area: SHL - Landfill Consol.	
Contractor:		Date Started: 6-28-95		Boring No.: SHB-95-28K		Protection: Mod D	
Method: D/W		Casing Size: 3"Ø Flush Joint (NW)		Completed: 6-29-95		PI Meter: TE/0UM	
Ground Elev.:		Soil Drilled: 27.2		Total Depth: 32.7			
Logged by: CPL		Checked by:		Below Ground: 2 19' bgs after drilling			
Screen: N/A (ft.)	Riser: N/A (ft.)	Diam: N/A (ID)	Material: N/A		Page 2 of: 2 (see Rock log)		

DEPTH (FT)	SAMPLE NUMBER	SAMPLE DEPTH	ON-SITE SCREENING	RECOVERY	PID (ppm)	SOIL/ROCK/DISCHARGE WATER DESCRIPTION	SOIL CLASS	Casing Blows/ft WELL DATA
25	5-6	25-26.2	N	12	0.0	SILT, 15-20% Fine sand 5-10% medium sand 5% coarse sand, 5-10% gravel, fines only slightly plastic. Sand is subrounded to angular, semi-dense 7.5R-4/2, no structure, (glacial Till) competent Bedrock @ 26.7, Rock core to 27.2. Start to core @ 27.2' bgs (See Rock Core sheet) Bottom Boring = 32.7' BGS	ML	7
27.5	R-1	27.2	to	45	45			100.2
30				50				
32.5		32.7						
35								
37.5								
40								
42.5								
45								
47.5								
50								

Grouted to Surface

ROCK CORING LOG

Project: Fort Devens		Study Area: SHL - Landfill/Conc		Project No. 8712-04	
Client: USAEC		Driller's Name: John Graglia		Logged by: CPL	
Drilling Contractor: D.H. Maher		Protection Level: Mod D		Checked by:	
Drilling Method: 3" Ø w/d (v.b) NQ (Redrock)		Rig Type: Mobil B-53		Start Date: 6-29-95	
Bit type/size: NQ (DC3E)		P.I.D. (øV): TE/ovm		Finish Date: 6-29-95	
Bit Use: Minimal		Casing Size: 3" (NW)		Auger Size: NA	
Core Interval (to/from) (ft): 27.2 - 32.7					

Depth (feet) Below G.P. Surf.	Sample No. & Penetration/ Recovery (feet)	Graphic Log	Natural Core Breaks		Weathered Condition	Rock Quality			Drilling Rate min/ft	Color	Rock Description and Comments on Drilling
			✓ = Natural	x = Mechanical		Total 4" Core	RQD (%)	Rock Quality Description			
26.7											Incompetent Rock
27											Competent Rock w/ Roller cone
27.2											
27.5	R-1				Now				2:53		Gray to greenish gray fine-grained meta sediment or meta-volcanic rock. Rock is very competent and all fractures are along previous healed fractures, and appear very flat. Fractures appear to be at angle to bedding or foliation and almost appear to be argillaceous. Rock is fairly siliceous and quartz appears to fill many of the healed fractures and forms the white stringers observed in the rock.
28											
28.5									3:30		
29											
29.5									4:35		
30											
30.5									5:05		
31											
31.5									5:10		
32											
32.5											1.5' of core in bottom of boring (core would not break)
33											B.O.B @ 32.7

197

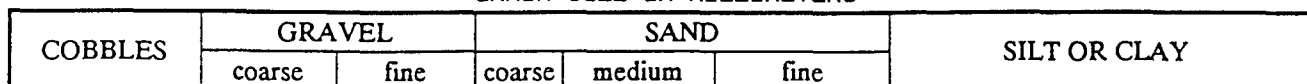
27.2
4.5
3.7

Healed Fractures
Fractures conjugate 120-60°
245° dip
Dark - Light
Stringers
weathered fracture
slightly
Recovery only 4.5'
Bottom of core
(4.5')
Penetration 5.5'

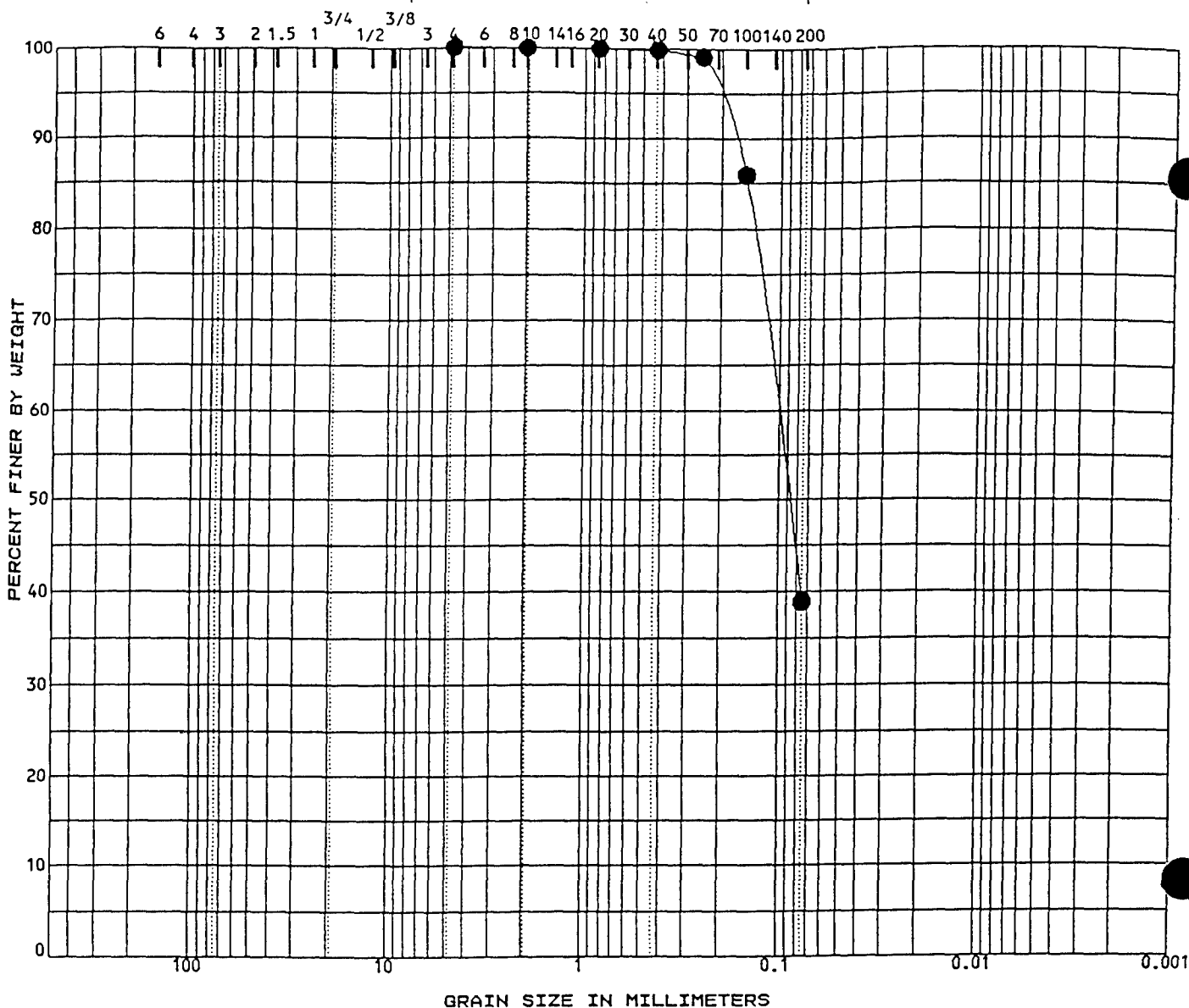
100%
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35.35 TOC
31.55 B65

GRAIN SIZE ANALYSES



Specimen Identification		Classification				WC%	LL	PL	PI	Cc	Cu
●	B-SHB-95-26	S-2 / 4'-6'				3.4					
		Fine SAND; little silt; trace medium sand.									
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	S2 4.0	0.85	0.18	0.103		0.0	85.5	14.5			
		Project FT. DEVENS				Location SHEPLEY'S HILL					
		Area				Notes CONSTRUCTION LANDFILL FS					
		Date July 1995				GRADATION CURVES					



GRAIN SIZE IN MILLIMETERS

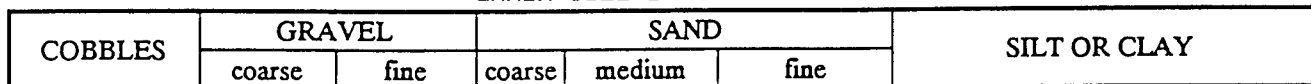
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	WC%	LL	PL	PI	Cc	Cu
B-SHB-95-26	S-4 / 14'-16'	23.5					
	Silty Fine SAND						

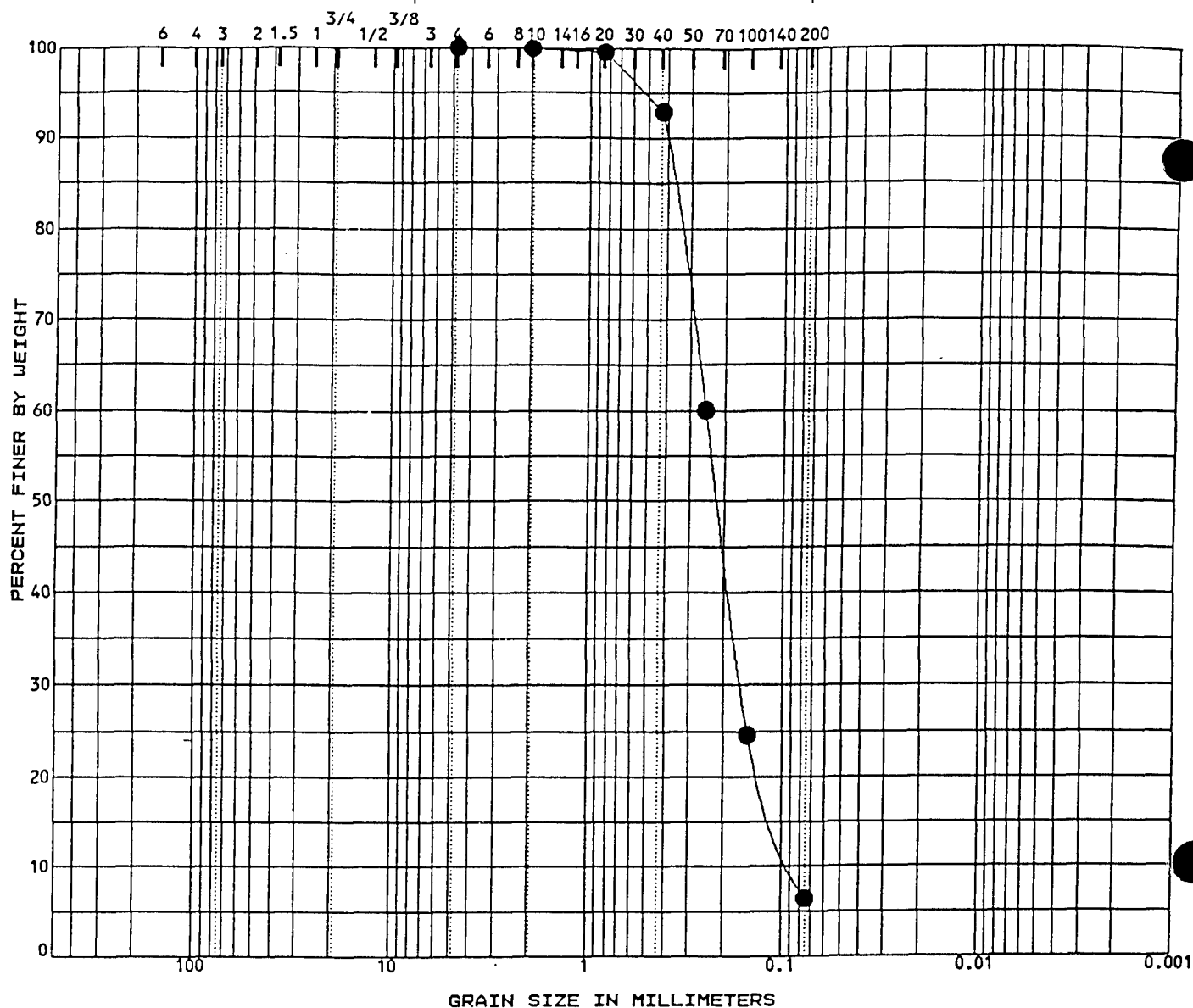
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
S4 14.0	4.75	0.10			0.0	61.1	38.9	

	Project	FT. DEVENS	Location	Shapley's Hill
	Area		Notes	Consolidation Landfill FS
	Date	July 1995	GRADATION CURVES	

HYDROMETER

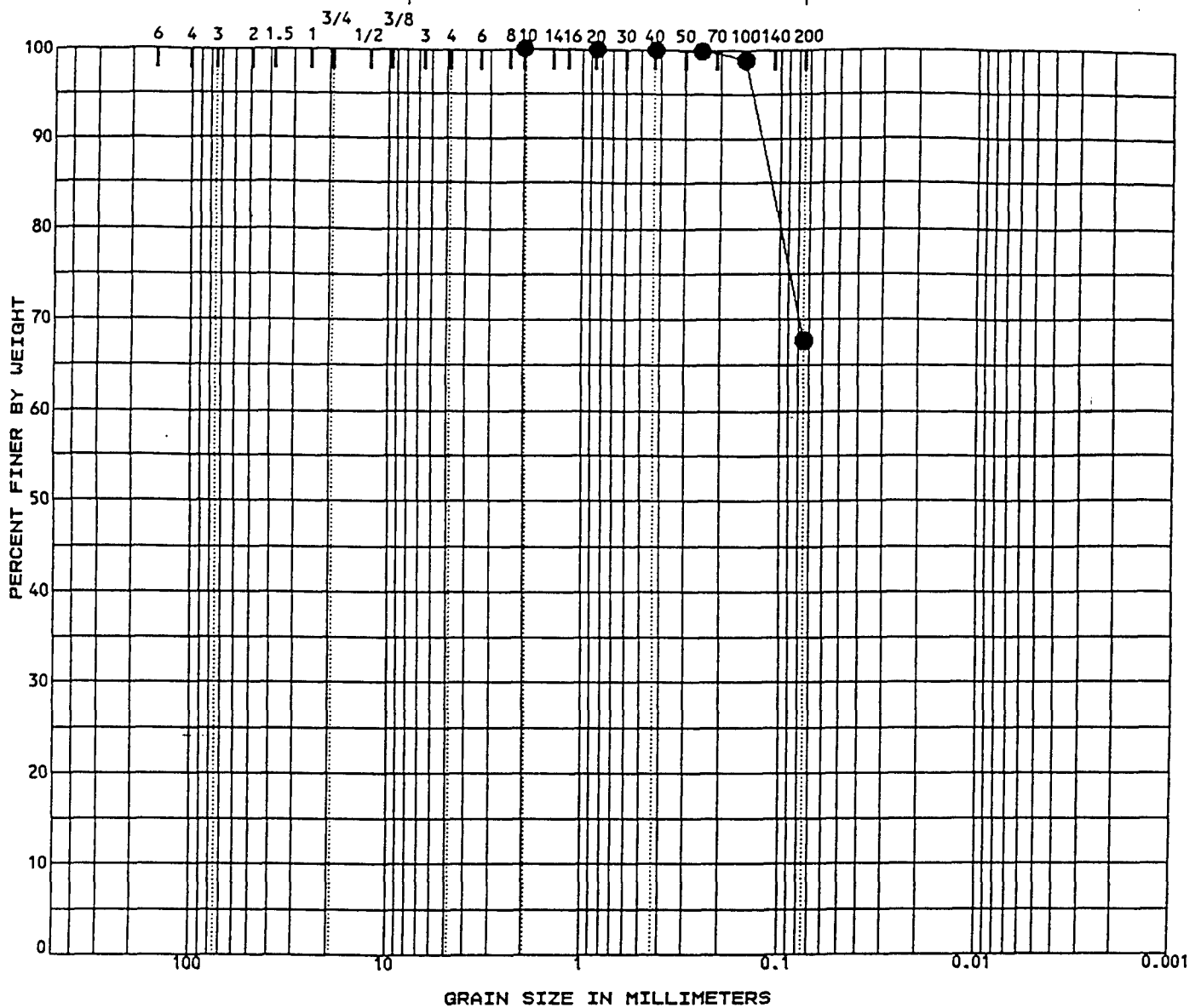


Specimen Identification		Classification				WC%	LL	PL	PI	Cc	Cu
●	B-SHB-95-26 - - -	S-9 / 39'-41'				23.8					
		Fine SAND; little silt; trace medium sand.									
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
●	S9 39.0	2.00	0.23	0.120		0.0	84.5	15.5			
		Project FT. DEVENS				Location SHAPLEY'S HILL					
		Area				Notes CONSOLIDATION LANDFILL FS					
		Date July 1995				GRADATION CURVES					



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification				WC%	LL	PL	PI	Cc	Cu
B-SHB-95-27		S-1 / 0'-2'				2.5				1.22	2.9
		Fine SAND; trace medium sand, and silt.									
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
S1 1.0		4.75	0.25	0.162	0.0860	0.0	93.6	6.4			
								</			



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification				WC%	LL	PL	PI	Cc	Cu
● B-SHB-95-27 _ _ _		S-4 / 15.7'-16.4'				22.0					
		SILT; some fine sand.									
Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
● S4 15.7		0.85				0.0	32.3	67.7			

